The automotive manufacturer

The Automotive Manufacturer

The Hub of Automotive Engineering

BODY BUILDING - AUTOMOTIVE PARTS - ALLIED INDUSTRIES

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The Hub ← A CONSOLIDATION OF → AUTOMOTIVE ENGINEERING

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Ideas from Abroad for Coach Building

What the Best Foreign Body Designers and Constructors Are Doing, Post-War Products and Departures from Usual Practice Noted in England, France and Germany.

WHILE great advances have been made in body building in this country in recent years, it must be admitted that the artists and workmen of many of the European countries lead us in their happy combinations of the artistic and the practical, notably in the smaller details and features which really make the fine body so desirable. In compliance with its plan to present for analysis and comparison, the work of the best foreign manufacturers as shown in post-war chassis, Automotive Manufacturer in this article will present for analysis and comparison some of the fine bodies. Many of these were shown in the larger motor shows of Paris, London and Glasgow, while others have been brought out subsequently. For considerable of the illustrative material, thanks are due to Cooper's Vehicle Journal (London), La Carrosserie (Paris), and Deutsche Fahrzeug-Technik (Gera-Reuss, Saxony, German).

The greatest interest of course is in the new things, new models, new methods, new lines, new materials. Besides these, the greatest improvement has been shown in the smaller (or lesser) features and details, which really form the groundwork of the body builder's art, in fact which mark the real coach builder off from those who just make bodies.

Besides the desirable changes in construction, which have added comfort, improved the appearance, and increased the refinement, great interest has been shown in reduction in weight. This is for two reasons, one of duced cost and the other and more important, of lowered running costs.

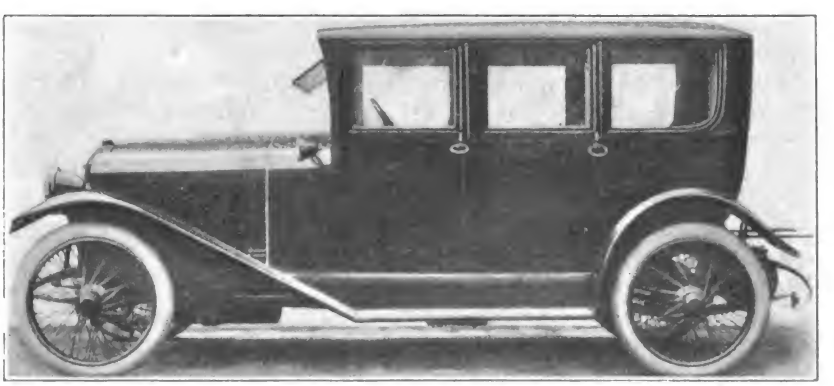

Fig. 1. The Duvivier (French) inside drive body. On the sedan order but its general appearance and square lines remind of the berline.

In the way of body forms, the enclosed or partly enclosed car with permanent roof or covering seems to have been most favored in all the foreign countries, as it is beginning to be in this country. Thus, the saloon (or as we call it, sedan), limousine, brougham and coupe are in the greatest demand in all of the countries mentioned, while in England only is the landaulet and all-weather type of convertible body popular. This latter type with one or two notable exceptions, is scarcely seen in France.

When one gets into a detailed examination of the French closed body work, it is noted that many French firms have followed the British school of design, as seen in the square corner pillar at the back quarter, and the front chariot or brougham pillar with moulding all round the lower quarter panel; indeed one coupe exhibited was almost a copy of the well-known Hooper (British) body. In this class of body, the French body-builder seems to have relied more on superfine workmanship than on a type radically new, but the designs even of the most luxurious limousines differ in a great degree from the same types of bodies which were the fashion in pre-war times.

While the egg-shaped domed roof drawing-room car, which is generally large and often cumbersome, has not been abandoned by the French, as several of the examples herewith will show, it has been replaced in part by a lighter refined body of an improved design, in which every inch of space has been taken advantage of and still giving apparently the same amount of room and convenience. Compared with the older

cars, the total dimensions of the body are much curtailed in order to reduce weight to a minimum. This may be said to be one of the most intersting points about the limousine. The experience gained in the construction of the more ambitious type of coach work has evidently been taken advantage of in many directions, the result of which will be gathered from our illustrations.

In considering the designs of the covered cars, it will be noticed at once that the latter are divided into two classes, those for the owner driver and those to be driven by the chauffeur. In all cases they have in proportion to their overall dimensions, deep lower quarter panels with shallow top quarters, lighter and much flatter, with little turn under and side sweep, as compared with bodies of this country. In many cases the bottom corners of the doors are left square, while square corners at the back panels are as much in vogue as the round. Frameless glasses are the rule, but in a few French instances vertical sliding glasses are fitted with excellent results; in another case the door glasses are cut horizontally and made to fold. In the single limousines and coupes the front pillars with curved toe finish mostly to a point, in other cases with a scroll; a large number of excellent bodies are to be seen both with and without moldings. The waist rails are narrow, devoid of moldings or any boxing, generally the edge is well rounded over. A feature of many of the limousines is the substitution of leather for wood or metal for the top side and back quarters, as well as the roofing. In many light bodies the roof is made up with seven light hoopsticks, ¾ in. square with five long slats about 1 in. by ⅛ in., all of dark polished wood, these supporting the head-leather, which is faced on the inside with a fabric to match the interior lining. The leather in every case on the quarters is neatly fixed with beading, while metal frames carry the oval or square lights in the quarters when quarter lights are adopted. For the saloon bodies, the partition at the back of the driver's seat is frequently to be seen with round corner fixed glasses with the centre one moveable, but in every direction the lightness of the framing is a noticeable point.

The French have entirely discarded the domed elliptical roof. All roofs are flat, finished with a cornice molding similar to the brougham type of England.

V fronts have also rounded corners; D fronts are fitted but are not so large as usually seen, standing out to only about 8 or 9 in. at the most. On one or two bodies the sloping front of the American car is to be seen, the heaviness in appearance bearing a marked contrast to the otherwise lightness of the French bodies. The proportional measurements of the French bodies cannot be compared with English ones, generally the limousines are only made to carry two persons on the rear seats. Many excellent folding seats turn up in the recess at the back of the driver's seat. In every respect bodies are narrower in width than those built in England, yet the seats are well positioned in relation to the back axle.

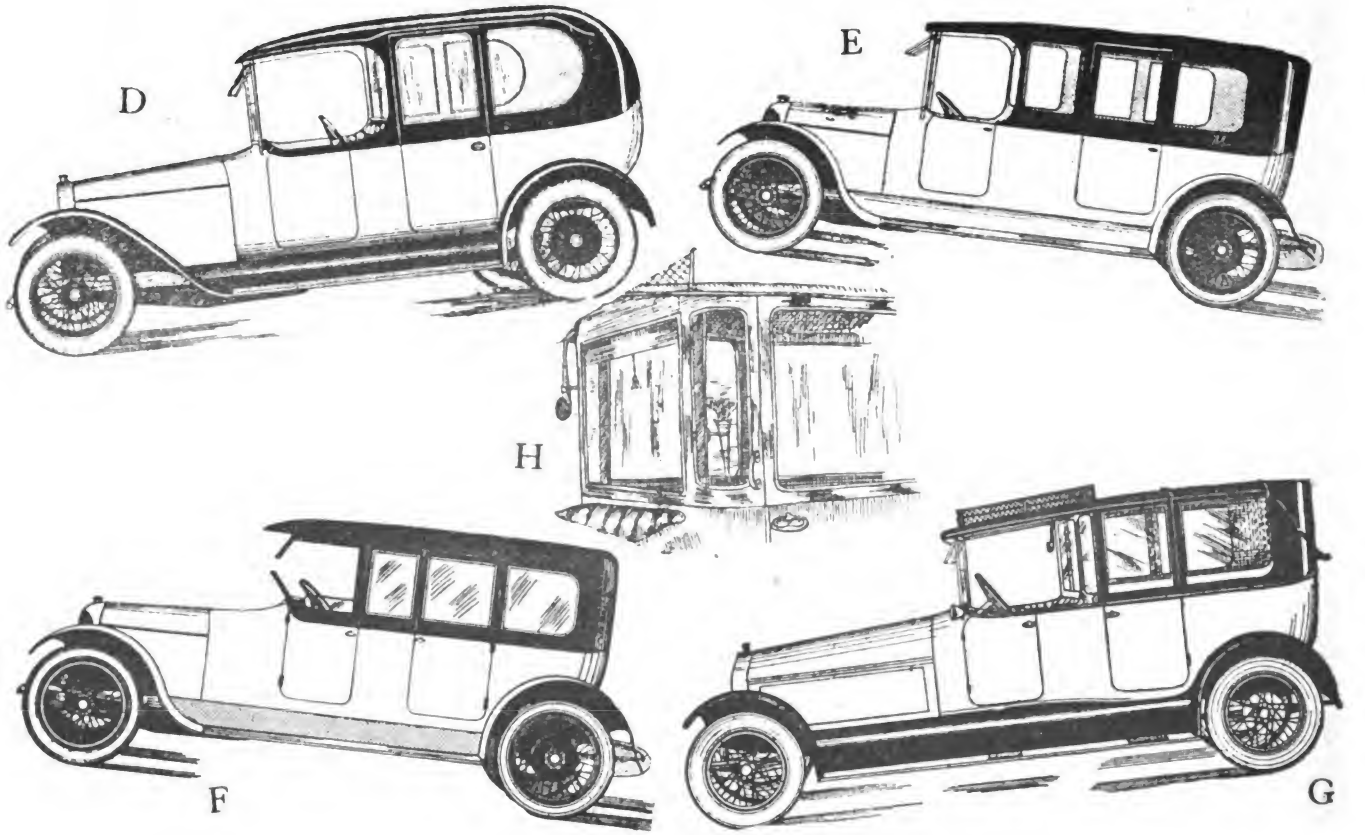

Fig. 2. A group of British, Scotch, French and Belgian limousines and landaulettes. D shows a Maythorne limousine de luxe, E is a Vandenplas job on a Hispano-Suiza chassis, F a Boulogne limousine, G Penman D-front landaulet on Armstrong-Siddeley chassis, and inset H detailed section of the Penman landaulet.

The painting of the cars generally presents the same excellence of finish long associated with French coach work. Quite a number of bodies at the Paris exhibition had the lower quarter panels sham caned in a dark color or black in place of the biscuit color of former days. A few bodies were fine lined, one had the bonnet and body double fine lined throughout.

All the French limousines, with few exceptions, are in Bedford cord, pleated or quilted. In the more expensive saloon and Pullman bodies, cloth and figured silk reps of an expensive character are utilized, with the best effect. Though the cushions gave a softness necessary to com-

fort, the depth from back to front is small in comparison with English ideas. Silk curtains and arm holders are generally put in the best cars. Doors are frequently left quite untrimmed, polished wood panelling being utilized. The neatness of the creasing and arrangement of quilting and buttoning in many instances are far superior to anything seen in England. In this direction the expert trimmer has much to learn from the French coach builder. The stretched covering on the auxiliary seats and the trimming on the staggered seats in the small coupes are object lessons in refinement of treatment.

In Scotland the permanently enclosed body with permanent top appears to be the most popular, consequently at the Glasgow exhibition the majority of bodies shown were saloons, limousines or coupes. In these types there is a larger field for more elaborate display than in any other body, and moreover, the price obtainable gives some scope to the builder. On the whole, the saloons were small and more compact in appearance than usual, with flush, well-rounded back panels and dome-shaped roofs, the majority having front moveable arm-chair seats, so that the owners, if they desire, could drive themselves. All were well upholstered, and though a rich, gratifying appearance was obtained, it was comfort and elegance without the gorgeous display of the cabinet-maker's work. The over elaboration in fitting up the interior with fancy colored woods was not followed to any extent, though in some judiciously employed for legitimate purposes as seen in the bodies of Penman, Dumfries and Smith, Aberdeen.

As has been stated, this same type of body is most popular in England, so that at the recent Olympia exhibition, one of the features was the proof of the ever-increasing demand for the enclosed car of saloon type, with its domed shape back and roof, large frameless windows, and polished wood interiors, of which many fine examples were to be seen in both the main hall and in the annex. Another was the number of high grade limousines, all of which demonstrated a vast improvement in the arrangement of the division at the back of the driver's seat. This partition was built up in a variety of ways, the majority with frameless glasses to drop or slide, in others a centre glass panel to fold into the roof, the corners rounded D shape with bent glass panels; in a few, panelled covered with cloth to match the upholstery and the edges finished with pasting and seaming lace. All gave evidence that no pains had been spared to produce a luxurious and comfortable body.

(To be continued)

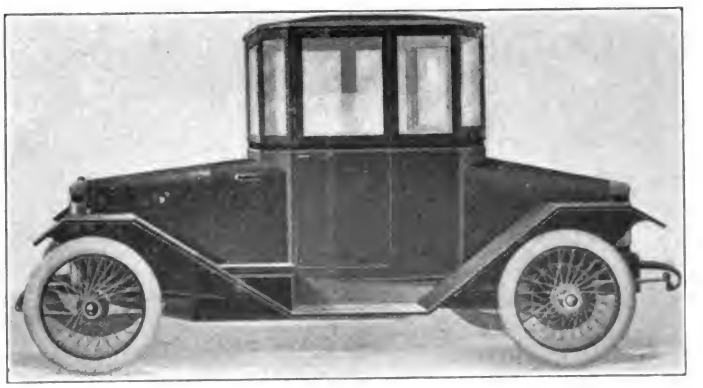

Fig. 4. A German straight line coupe body, with rear deck constructed exactly like the motor bonnet so the body appears double ended. Except for the doors, the exterior is symmetrical about the central point.

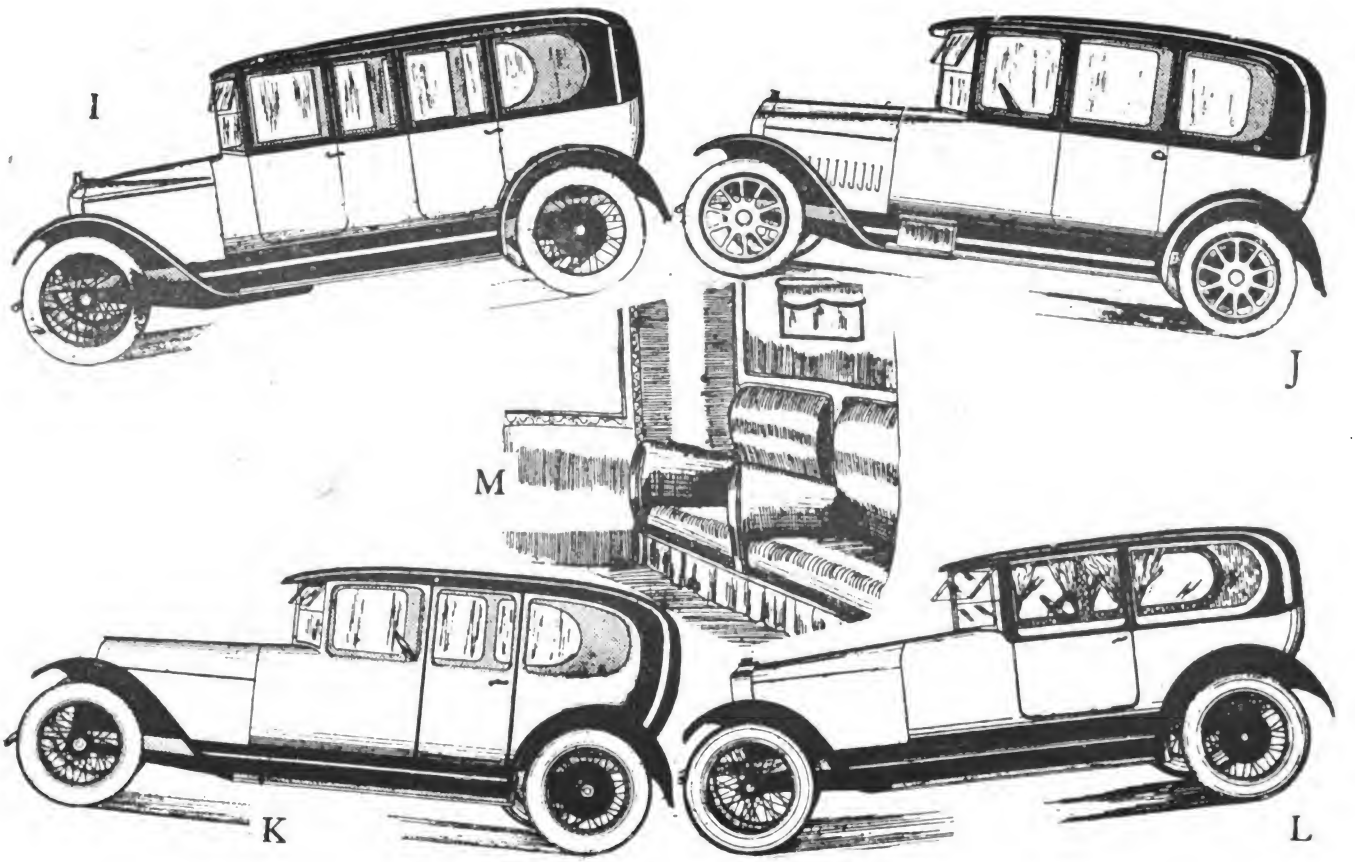

Fig. 3. A group of British sedan bodies. I shows a four-door body on a 25 h.p. vauxhall, J a two-door form on a 15.9 Humber, K a Cunard job on a 30 Sheffield-Simplex, L a four-seater by Beadle on a 25 Talbot, inset M interior of a saloon with divan seats by Labourdette on a Brasier chassis.

Fine Coachwork from British Shops in Lanchester

Details of Vee-Fronted Sedan, Called Saloon Body, on 40-Horsepower Six-Cylinder Chassis Described in Last Issue

IN the last or March issue, there was described in considerable detail one of the best of the British post-war fine cars. This, however, was strictly of a mechanical nature, and dealt with the mechanical features only, so that it was of little interest to the body builders. Herewith, there is shown and illustrated a form of sedan, or as the British call it, saloon, body to be mounted on the chassis previously described. In Fig. 1 is presented the chassis drawing with those dimensions which a coach builder would require, and in Fig. 2, the special saloon body constructed for exhibition at the Scottish show.

Following this, Fig. 3 presents the carriage maker's working drawings, which are reproduced through the courtesy of Coopers' Vehicle Journal. These it will be noted refer to a body of the same general design, but altered in a few small particulars, thus the space between the two doors is reduced in the Scottish Show Model so much as to eliminate the window there. This extra length is put partly into the rear door width, but mostly into the front door, making that of unusual width, which as we have found in this country is most desirable. The other slight differences can be noted by comparing protograph and drawing.

With reference to the latter, this design comprises all the best features of the typical saloon, and is fitted with double doors on each side, the body having also large quarter side lights, back and front, the interior giving seating accommodation for five persons. The outline of the body is of the moderately domed shape pattern, consisting of a combination of curves, graduated in perfect harmony in each direction and in accordance with what is considered the best taste for this type of body, and, as such, should prove pleasing to the eye and in every way satisfying to the most critical expert of high-class work.

The more notable features of this design are to be seen in the sloping front with its triangular shaped windows, the front sloping backwards exactly 22½ degrees, to a distance in the cross-width, so that the top deflected panel of the glass screen in whatever position it is used, does not interfere with the vision of the driver. The body being comparatively low set, additional height is obtained at each door by the upswept door rail. The roof cornice follows the line of door, and being then curved into the line of the cant rail, relieves the monotony of the usual plain roof line. All the corners of the light lines on the body are uniformly swept, while the glasses are of the frameless type, which should be moved with one of the mechanical devices now in general use for this particular class of work.

The body being designed to fit the new Lanchester chassis, body-builders would be well advised to study carefully many of the details of the chassis, such as the contour of the rear of bonnet, and the adjustable steering column, the width and taper of the front part of the chassis frame, all of which in a measure facilitate the fitting of an attractive "all-enclosed" body, in which the side panelling may with skillful treatment on the part of the metal workers be productive of long easy flowing lines in each direction. On reference to the working drawing and tabulated measurements, it will be noticed that the dimensions are given on the square line, for this reason: that in all bodies of this type having a wholly curvilinear contour, it is only possible to give set measurements by a series of well-defined points which every body-maker will readily understand, and can mark off for himself correspondingly in making the enlargement a full size drawing, and by transferring them by means of a series of squares, lightly penciled over the drawing. In that way an exact replica of the lines can be obtained.

In the construction of the body clean mild English ash with that of a harder nature for the bottom frame is necessary; the runners and the cross bars are fitted to

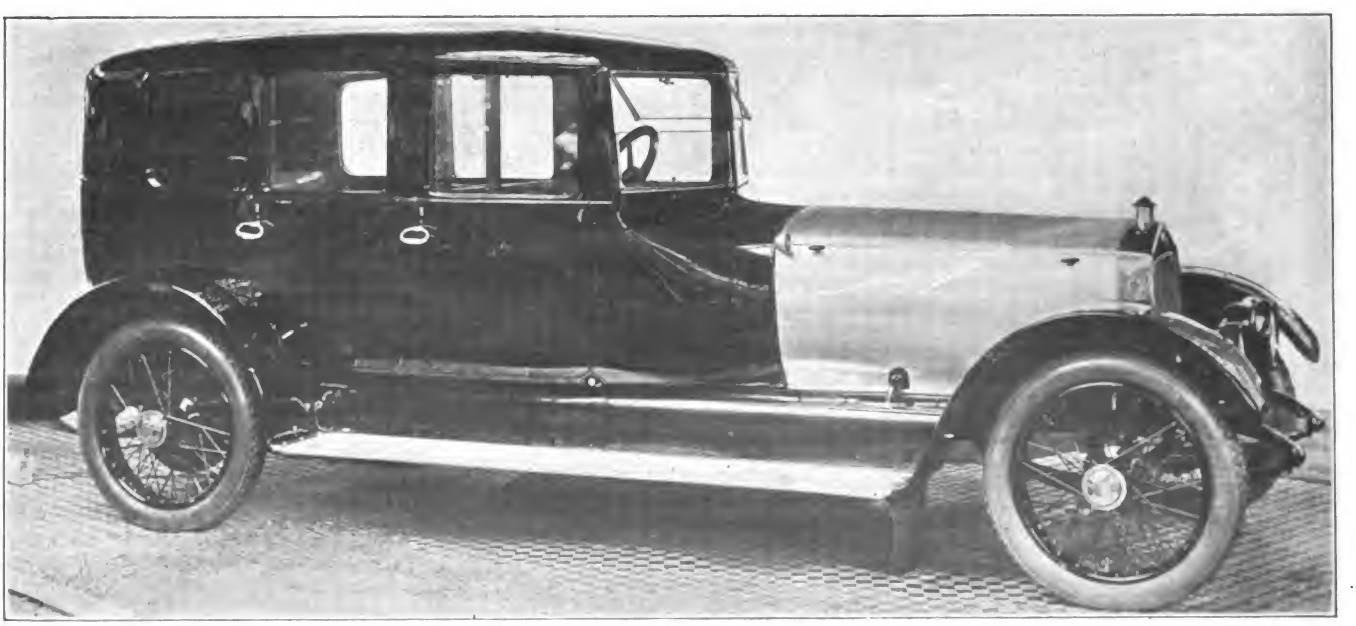

Fig. 1. Vee-fronted saloon or sedan body on the new Lanchester post-war chassis, Scottish Show Model.

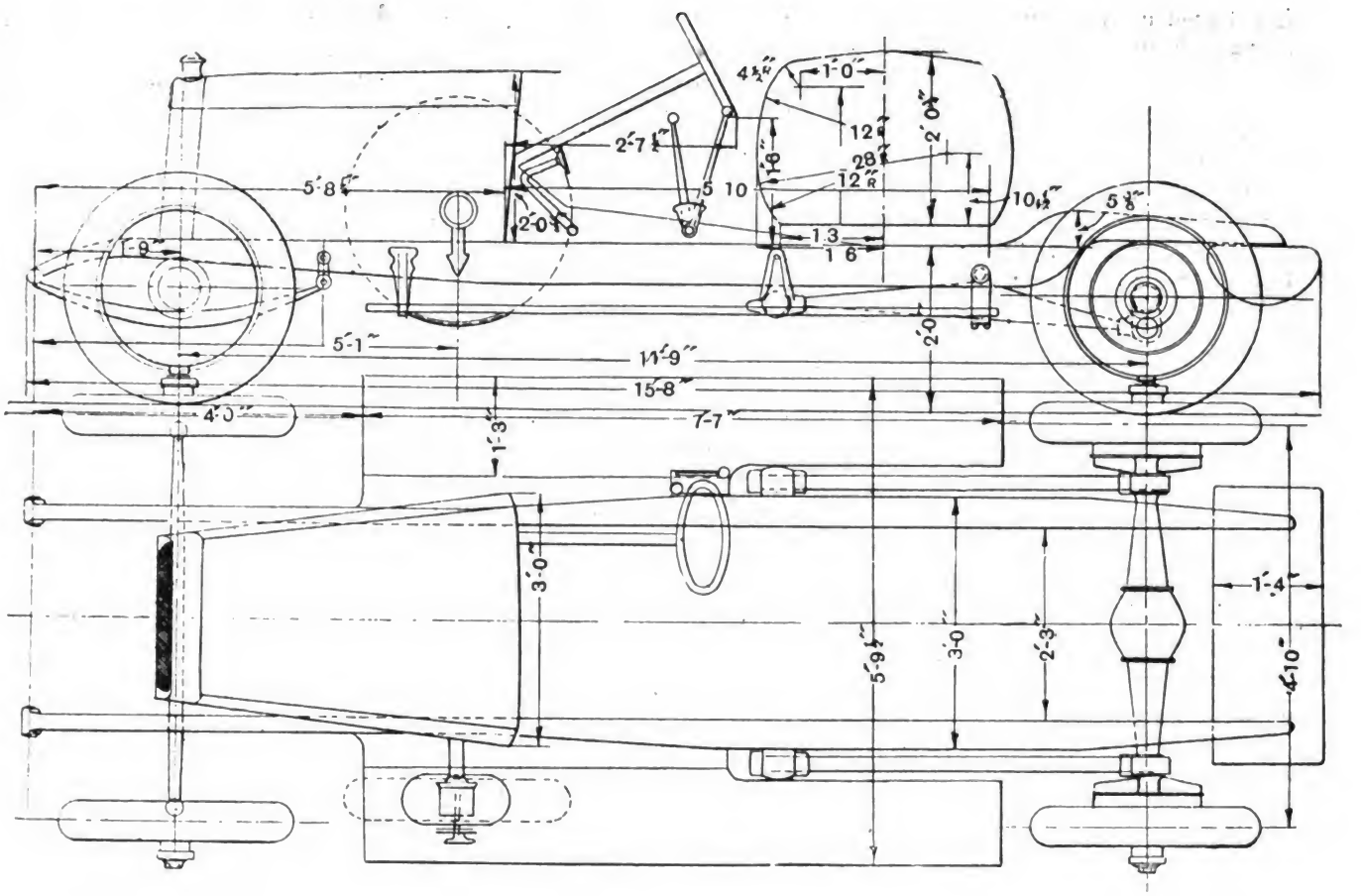

Fig. 2. Body builder's drawing of Lanchester 40 h.p. six-cylinder post-war chassis, giving dimensions needed to build bodies.

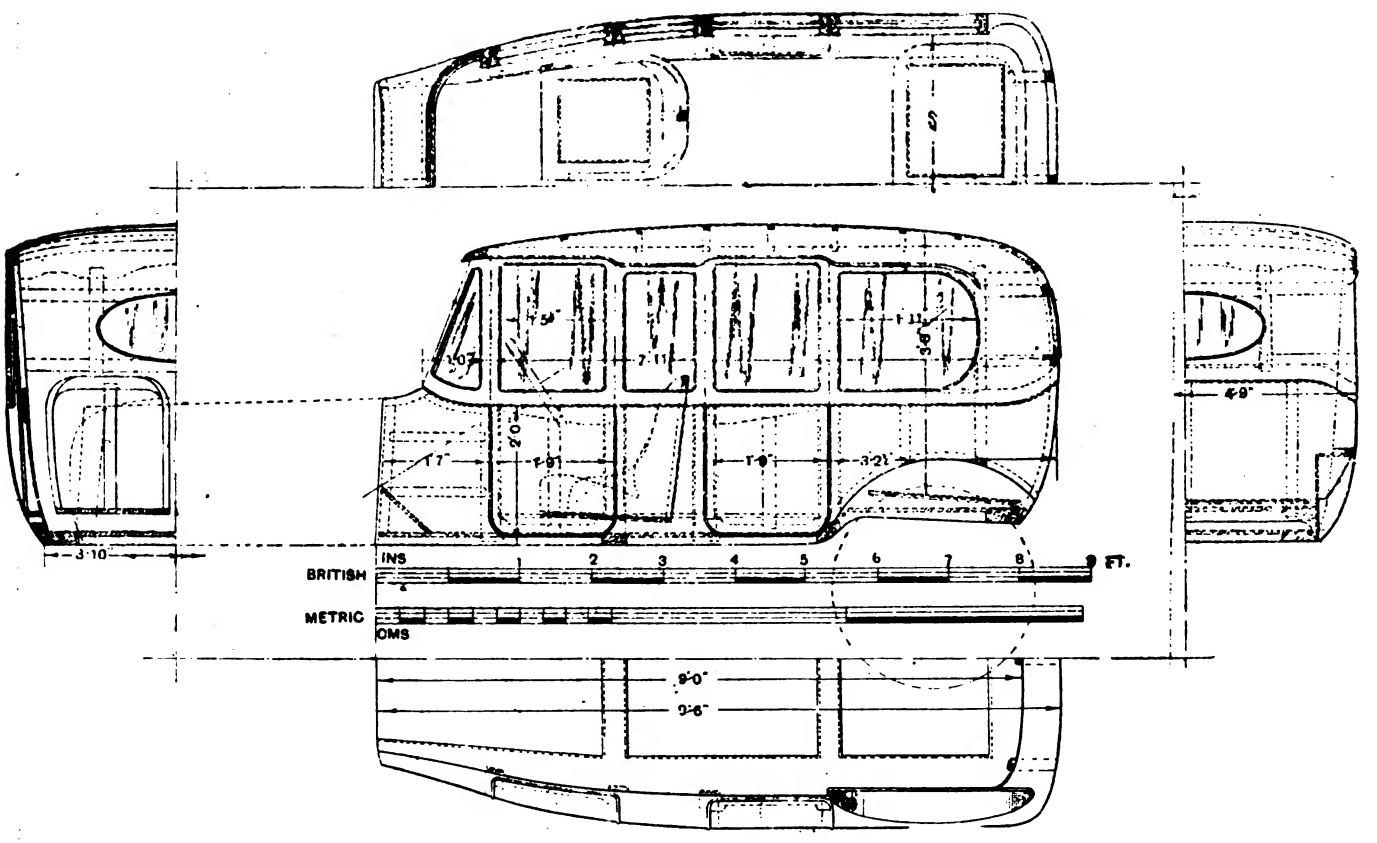

Fig. 3. Working drawings of vee-fronted saloon or sedan body for new Lanchester chassis.

the frame according to the usual practice; the building of the rear part is similar to usual practice except that the back is battened up, to shape out and rebate for a large oval shape light. We also have double door standing pillars to erect with the breast rail to form a quarter light at the front rail. It will be noticed that the breast rail shows a depth above the elbow line of 3 ins., but the actual depth of the rail as also the door rails is some 4¼ ins., this extra substance being necessary to work up the round corner shown in the light line, the joint coming thus above the fence line of body. The pillars are framed with bare shoulder tenon on to the bottom frame, and tenoned into the cant rails which are kept deep, to round up. The front swept corners are stump tenoned into the standing pillars, and lapped on to the sloping screen pillars and secured by screws, the top extremities lapping on to the top cross rail, the rails and pillars being rabbeted from the outside to take the bent glass, which is fitted and bedded in sheet rubber and secured by fillets screwed on. In fitting this glass the greatest care is necessary that there be no twist on the frame and also that the framework is very stiff and rigid, and to ensure this, a body plate is fixed up the inside of the pillar made from 1¼ in. by ⅜ in. half round iron with two flaps, one at the top, and one at the bottom, which are screwed on to the corner rails. All the pillars are braced together with the breast rails, which are lapped to them, the lower edge forming the elbow line of the body, which it will be seen gives a ¼ in. off-set from the lower panelling all round. The doors being fitted and the body rounded in and cleaned off, it is ready for the panels, which require considerable beating and fitting to the turn-over of the top quarter panels to maintain the correct line of body on the elbow line.

General Dimensions.	ft.	ins.
Length on bottom of body	9	0
Length over all on elbow line, measured square.	7	11
Length of body on cant rail	8	1
Depth of front on elbow line	1	0
Depth of scuttle	1	7
Width of doors	1	9
Length of hind quarter on elbow line	3	2½
Length of front quarter light	1	5½
Length of rear quarter light	1	11
Depth of body side in centre of door panels	2	0
Door tops above light line of body	0	2½
Width of body over all at hind standing pillars.	4	9
Width on bottom of body	3	10
Head room above rear seat	3	8

All the material is ash, except the paneling and roofing of aluminum, the flooring of pine, and the lining boards of pine.

Details of Framework.

No. of Pieces	Part	Length ft.	Length ins.	Width ins.	Thickness. ins.
2	Runners	9	0	6½	2
—	Cross Bars	3	0	5	2
2	Front Standing Pill	4	1	3¼	2¼
2	Hind Standing Pill	4	1	3¼	2¼
2	Back Pillars	3	0	2¾	2
2	Corner Pillars	3	8	2¼	1½
8	Door Pillars	4	0	3¼	1½
4	Door Rails	1	8	4¼	1½
4	Door Top Rails	1	8	2½	1¼
4	Door Bottom Rails	1	8	3½	2
4	Door Battens	1	10	1½	1
2	Cant Rails	8	1	5	2¼
1	Front Top Rail	4	0	4	2
1	Front Middle Rail	2	6	3	2
1	Back Rail	3	7	4	1¼
1	Hind Top Rail	4	2	4	2
7	Hoop-sticks	4	9	1	¾
8	Body Battens	1	8	1¾	1
8	Scuttle Framings	1	6	1	¾
1	Seat Rail	4	2	2	1½
—	Panelling		65 ft. super.		18 BWG
—	Roofing		38 ft. super.		18 BWG
—	Flooring		30 ft. super.		¾
—	Lining Boards		26 ft. super.		¼
2	Running Boards	7	4	11	1
2	Screen Pillars	2	4	2¼	2¾

Resistance to Decay Important in Airplane Wood

Airplanes in the past have been so short-lived that it has mattered little whether the wood in them was resistant to decay or not. Now with better construction and less accidental breakage of airplane parts, instances are coming to the attention of the Forest Products Laboratory of parts needing replacement because of decay.

The fact is being recognized that many woods in common use for airplanes are not resistant to decay and may be destroyed very rapidly when exposed to unfavorable weather conditions.

Fortunately, there are woods whose value in aircraft has been demonstrated which are highly durable. Among these perhaps the most notable is Port Orford cedar. Two others which in tests made by the laboratory have proved very resistant to decay are southern cypress and California redwood. Douglas fir, white oak, and black walnut stand fairly high in durability. Mahogany and Spanish cedar are reputed to be very durable, but no tests have been made on them in the United States. Spruce, which has been the favorite wood for aircraft, is, unfortunately, appreciably less durable than any of the species mentioned. Likewise basswood, beech, birch, and maple may be classed with the less durable species.

The sapwood of practically all species decays readily. Hence in selecting wood for durability, only the heartwood should be accepted.

In cases where it is not practicable to use a naturally durable wood, the life of the wood part may be prolonged by giving it a preservative treatment. Sodium fluoride is a preservative which may be successfully used on parts that are to be glued. Coal-tar creosote, where its color and odor would not be objectionable, may be used for parts that are not to be glued. Decay in struts, propellers, and some other large members can be prevented by applying a coating of aluminum leaf. This keeps the wood dry, and dry wood does not decay.

In 1918 the London omnibuses carried more passengers than the subway trains and surface cars together, the figures being: Buses, 652,562,327; tubes, 379,438,072; street cars, 198,334,499; total all three, 1,230,334,898. Somewhat the same proportions hold for the last ten years, the figures being: Buses, 5,818,374,141; tubes, 2,881,264,160; street cars, 1,760,720,397, and the total, 10,460,358,698.

Modern Tendencies in Engine Design*

By L. H. POMEROY†

Other Fuels than Gasoline, Crankcase Lubricant Dilution by Gasoline, Distribution a Carburetion Problem, Best Materials for Various Engine Parts, Light-weight Construction, Advantages of the Short Stroke Eight-Cylinder Drawbacks

THE use of benzol in even small proportions of 10 to 20 per cent will allow much higher compressions to be used than are possible without such addition. The admixture of cooled exhaust-gas has the same effect and has been used for many years on producer-gas engines where very high compressions are common. The application of this idea to gasoline engines generally is now being worked out and will doubtless become common. The difficulties are purely of detail application and in the automobile engine largely arise through the necessity for part-throttle working. I have applied cooled exhaust-gas to a badly carbonized engine that simply would not run at full throttle with the result that full throttle could be used, the torque obtained being within 1 per cent of that given by the same engine when clean.

The subject of gasoline deposition in the crankcase is one of more practical importance than a problem involving physical speculation. It has been known for many years that the lubricating oil in the crankcase gradually absorbed gasoline, and retained such fractions as were not volatilized at the temperature of the lubricating oil during use. With prewar gasoline, the maximum absorption was about 4 per cent. Nowadays, when fully one-third of standardized gasoline does not vaporize under a temperature of 140 deg. Cent. (284 deg. Fahr.), deposition is much more serious. It can be dealt with once and for all by the use of the crosshead piston described above. On the other hand, this cannot be applied without radical alteration in design. The use of high-temperature induction pipes is therefore indicated to vaporize the gasoline-air mixture as much as possible before it enters the cylinders. The standard method of exhaust jacketing the induction manifold seems defective in that the heat supply is least at part throttle, when it is most required, and greatest at full throttle, when it is least required. The correct way seems to be to reverse this state of affairs. A device which would satisfactorily and automatically pass the greater part of the exhaust-gases through the manifold jacket at low throttle and only a small portion at full throttle appears to be desirable.

Such a device is illustrated in Fig. 13. It depends for its action upon the vacuum in the inlet manifold, which is more or less in accordance with the necessity for external heat supply. The spring-loaded piston is in communication on one side with the induction pipe and at the other forms a valve controlling the amount of exhaust-gas which can pass into the inlet-manifold jacket. At a small throttle opening, or a high vacuum in the induction pipe, the maximum amount of exhaust-gas is passed into the manifold jacket while at full throttle, or a low vacuum, the supply of exhaust-gas is cut off, thus avoiding unnecessary preheating of the mixture.

It seems probable that the maximum deposition of gasoline in the crankcase occurs when the engine is started. At this time the cylinder walls are covered with cold oil which is quickly scraped off by the rings and not replaced with further lubricant until the engine becomes warm. Further, the gasoline which is used during the first few minutes after starting is that which is left in the float-chamber after the previous run, from which the lighter fractions have already in all probability disappeared. The same condition holds for vacuum tanks, where the surface of the gasoline is exposed to the atmosphere. It was the custom among the drivers in the Mechanical Transport Department in France to drain the carbureter float-chamber before starting up and, as engine starters were not in common use, the practice may be accepted as one that was really necessary. Since the preheating of induction-pipe manifolds before starting is very advantageous, the draining of the float-chamber, if arranged for, as it can be, so that no troublesome operations are involved, will minimize the serious effects of gasoline deposition.

In respect to carburetion generally, the difficulty is primarily in securing proper distribution. It has been realized that it is much easier to produce a spray of gasoline and air in requisite proportions at all loads and

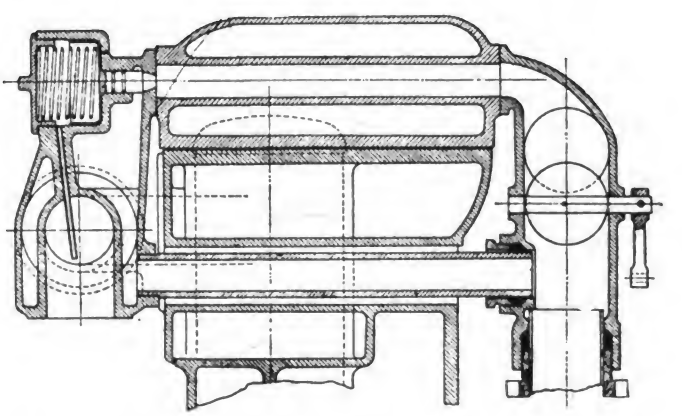

Fig. 13. Device for using most of exhaust gases at low throttle to heat induction manifold and only a small part at full throttle.

speeds, than it is to insure that this spray is distributed equally in correct quantity and quality to the cylinders. There does not seem to have been much radical improvement in induction-manifold design, although there is less variation in this respect in engines that existed a few years ago. The principal detail improvement is possibly the reducing of the size of the manifold so that a high gas velocity is attained through it. There is a real need for an inlet manifold the area of which will adjust itself to the requirements of the moment, being large at full load and small at light load. A flexible lining of the manifold, with a space between it and the manifold open to the atmosphere, would seem to possess the property of collapsing at light loads when the vacuum in the manifold is high and of expanding at full load when the vacuum is low, thus producing an area proportional to the load.

*Concluded from page 11, March issue.
†Consulting engineer, Cleveland, Ohio.

On the whole the situation is probably accurately summed up in the words of Mr. Howard Marmon to the author, "No deposition, no distribution problem."

The "war spirit" used in England during the last three years, when fractionally distilled, only evaporated some 70 per cent of its volume under 140 deg. Cent. (284 deg. Fahr.), while 0.76 Shell was completely evaporated at this temperature.

The Choice of Materials.

It would be neglecting the subject of the trend of engine design not to deal somewhat fully with materials, and the principles underlying the choice of material for various purposes. The literature and practice of the past five years indicate that the physical properties of materials are considered far more intelligently than ever before and that design is based upon some knowledge of the real and intrinsic merits of the materials in use. The term "a stiff steel" is seldom heard now that it is more generally appreciated that all steels possess approximately the same stiffness. Further, the nature of fractures and the causes thereof have received much attention by metallurgists, or rather the metallurgists have come out of their lairs, removed their all-seeing eyes from their microscopes and condescended to explain to the engineers in fairly plain English the nature of the metals they use and the mechanical properties these metals possess. Even at this date papers are being read by eminent metallurgists speculating upon what happens when a piece of steel is broken.

The principal materials at the disposal of the engineer are as follows:

Steels, alloy and carbon, both high-tensile and case-hardening.

Cast iron.

Aluminum, forged and cast.

Bronze, phosphor and manganese alloys.

Bearing metals containing lead, tin, copper and antimony.

The choice of material for any specific part calls for considerable judgment to obtain the best results. It is perfectly easy to specify a high-tensile alloy steel for a crankshaft on the grounds that this is accepted high-class practice, although for automobile engine purposes, even of the highest class, this may be sheer waste of money. The average stress in a chankshaft of the solid type is very low, and does not justify high-tensile alloy steel except from one point of view. This is the local increase of stress in small fillets explained previously. As the intensity of stress in a fillet varies inversely as a high power of the radius, it would seem far more rational to eliminate these high local stresses by increasing the radius of the fillets, than to use a considerable weight of high-tensile material all through with attendant expense and difficulty of working. In all cases, subject to the above reservation, the dimensions of a crank are those required for stiffness rather than strength, and are largely in excess of stress requirements. The actual deflection under a given load of two crankshafts of identical design is strictly in proportion to the relative moduli of elasticity of the materials of which they are composed. These do not vary more than 2 or 3 per cent in any of the steels in common use, the higher values for stiffness being frequently obtained with the lower-tensile steels. For the above reasons there is little advantage in the use of expensive alloy steels for cranks unless their properties are essential to overcome bad design or are made necessary by the need of a reduction in section without sacrificing stiffness, as in bored-out aeronautic engine crankshafts. In fact, the use of carbon steel properly heat-treated is very much overlooked in engine construction generally. The advantage of alloy steel has largely disappeared with increasing knowledge of heat-treatment and stress distribution.

Tensile Strength Tests Best.

In respect to physical tests, the old-fashioned tensile test probably gives the best indication of the relative qualities of steels in general, in spite of the fashion to regard shock and fatigue tests as decisive. It is worthy of remark that the high-tensile steels invariably give much lower impact-test figures than low-carbon low-tensile steels. The real point is that impact and fatigue tests only convey information as to the capacity of the material to resist fracture, when stressed outside its elastic range. If such stress conditions occur, fracture is bound to occur sooner or later, and if such is the case, the precise amount of energy absorbed during fracture does not possess much interest. It seems more important to have accurate information upon the true limit of proportionality of stress and strain, and in general much more information of the behavior of steel inside the so-called elastic range.

My practice in specifying and using steel has been to insist upon having the analysis of the steel within reasonable limits and to be sure, from micrographic examination, that the steel possesses the desired structure for the particular purpose intended. With these two points assured, physical properties will usually take care of themselves. An illustrative example of the futility of trying to combine high-tensile and high-elongation properties arose in England during the war in connection with aeronautic engine crankshafts, many perfectly sound cranks being rejected which would have been passed in the light of analysis and micrographic examination.

Of cast iron, little need be said except that machining and wearing properties are usually inconsistent with each other. It seems a pity to use soft cast iron which wears rapidly at the high piston-speeds in common use, for the sake of a slight saving in machining time.

Aluminum has been greatly improved in the last few years. It is beginning to respond and yield to the ingenuity and long-continued ministrations of the metallurgists. The ideal of combining its lightness with the properties of steel is still far off, but very much of its frailty of character has been removed, without affecting its physical lightness. In the cast state, it is possible to obtain an ultimate tensile stress of 27,000 lb., with an elastic limit of 10 000 lb. and an elongation of 5 to 6 per cent. The elastic limit is sufficiently well marked to indicate that it can be raised by overstrain similarly to that of steel. A new material is thus presented to the engineer.

Advantages of Aluminum.

The peculiar virtue of aluminum for castings is that the weight is not limited by foundry considerations, as in the case of cast iron and cast steel. This renders possible a scientific disposition of material, which is exceedingly important in getting the maximum effectiveness out of a given volume of metal.

It is safe to say that 90 per cent of engine castings could be made with perfect safety from the same drawings, whether in aluminum or other cast metal, thus re-

ducing the weight by about 60 per cent. By taking advantage of the freedom of design conferred by the strength qualities and light sections permissible in aluminum, this reduction in weight for a given casting can be considerably improved. In the case of the cylinder, problems of wearing surface arise apart from foundry considerations, but the use of the aluminum cylinder with inserted liners has already proved so successful in aeronautic and automobile practice, as to justify serious attention from the point of view of present and future design. Nor is the high cost of aluminum so serious a bar to its wide adoption as would appear. As against malleable iron, it is about three times more expensive. As it is about one-third the weight, castings from the same patterns would cost about the same.

Continuing, the author points out that this material is not always the most desirable, and that the case for aluminum as a structural material rests upon the ease with which it can be worked, the absence of foundry limitations, and the fact that the strength of cast aluminum is far in excess of what it was a few years ago.

The relative weights per unit tensile strength are as follows, the figures being based upon the ultimate tensile strength in each case:

	Weight per Cubic Foot lb.	Tensile Strength lb. per sq. in.	Tensile Strength÷ Weight per Cubic Foot
Aluminum	170	27,000	159
Gun Metal	500	31,000	62
Malleable Iron	480	40,000	83
Cast Steel	480	60,000	125

As a material for flywheels, aluminum would seem unsuitable, as indeed it is for certain classes of engines, but even for this purpose its inherent strength for a given weight calls for attention. The usefulness of a material for flywheels is determined by the peripheral speed at which it can be run without bursting from centrifugal effects. From this point of view a material is required which has a high ratio of strength to weight per cubic inch. Comparing forged steel with an ultimate strength of 80,000 lb. per sq. in. to cast aluminum with an ultimate strength of 27,000 lb. per sq. in., we obtain the following:

$$\text{Forged Steel} \frac{80000}{0.28} = 2.88$$

$$\text{Cast Aluminum} \frac{27000}{0.1} = 2.7$$

showing that for cases in which space considerations do not set a limit, as in automobile engines, aluminum is far from being a negligible material for flywheels. It is probable that for moderate-sized flywheels, such as are required on direct-driven alternating-current generators, the use of aluminum would be economical in comparison with forged steel. The use of aluminum is also indicated for turbine disks and other cases in which the limit of speed depends upon inherent strength to resist the forces set up by inertia and centrifugal forces. Although these examples are not directly connected with automotive engine design, they are suggestive by reason of the fact that engine sizes and speeds are now rapidly approaching the state in which stresses due to inertia form the basis of engine design.

It is also of interest to compare similarly the strength of forged aluminum with that of various steels, taking for examples a mild carbon steel, a high-tensile carbon steel and a high-tensile chrome steel.

	Weight per Cubic Foot lb.	Tensile Strength lb. per sq. in.	Tensile Strength÷ Weight per Cubic Foot
Aluminum (forged)	170	60,000	350
Mild Steel	480	60,000	124
High-tensile Steel	480	100,000	208
Nickel-chrome Steel	480	135,000	280

The advantages of aluminum in replacing steel forgings are best exemplified by the case of the connecting-rod. In the case of a steel connecting-rod, minimum weight can be obtained only by delicate machining operations, which are further complicated by the necessity for avoiding sharp radii and fillets to obtain good stress distribution. In other words, the normal steel connecting-rod is about twice as heavy as it would need to be if the material could be properly utilized. With forged aluminum difficulties in respect to machining operations and stress distribution naturally disappear, and the designer has so much "lightness in hand," so to speak, that local high stresses, as for example those in the middle of the big-end cap parallel to the crank axis, can be dealt with liberally without appreciable increase in weight.

In general, compared with steel, the case for forged aluminum rests upon the fact that the strength of members subject to bending or torsion depends upon the ultimate stress and the cube of a linear dimension, while the weight is a function of the square of a linear dimension. Thus, comparing two square beams subjected to bending, one being 1 in. square and the other 1.41 in. square, the second is twice as heavy, nearly three times as strong and four times as stiff as the first, thus showing the overwhelming effect of dimensions per se and the relative unimportance of high tensile strength in members where ample space is available, as in the case of the connecting-rod mentioned above.

Lightness of Construction.

The development of the aeronautic engine has focused the attention of designers and the public upon the light engine. In the case of the aeronautic engine, lightness is obtained mainly through machining out low-stressed portions of the various members concerned and because the large size of these engines renders them less susceptible to the limitations imposed upon lightness by foundry and forge considerations. It is not necessary to use twice as much material as is required to make a part which would work perfectly, providing it could be got in place without its being broken by dropping upon the shop floor. In the case of gasoline engines generally, such methods of obtaining lightness are either precluded or prohibitive in cost.

The author then takes up some items which influence light weight, and calls particular attention to the advantage of the short stroke engine in this respect. Taking two specific examples, he points out that equal speed may be obtained and then continues that it is obvious if the mean effective pressure is independent of the stroke-bore ratio, the same power will be developed by engines of the same cylinder capacity at the same speed. Aeronautic engine experience throws considerable light on this question, some of the latest engines being of the short-stroke type and developing mean effective pressures as high as

those with longer strokes. In aeronautic engines overhead valves are universally used, so that adequate turbulence is obtained in the combustion chamber, due to the compact shape of the latter. In the case of automobile engines it is undoubtedly easier to obtain turbulence in long-stroke engines with side valves, than in short-stroke engines with side valves, but the difference is only a small percentage and there is, as already indicated, a reason to believe that the combustion chamber of a side-valve engine can be modified so as to negative entirely its apparent deficiency in respect to turbulence.

If, then, the problem of stroke-bore ratio can be denuded of its power aspect, which also carries with it thermal efficiency, the ratio of stroke to bore can be settled on the basis of minimum weight and manufacturing convenience. From these points of view the short-stroke engine has everything in its favor. To begin with, the overall length of the engine is usually settled by the summation of the valve diameters, which are necessarily settled by the cylinder capacity, being the same for both long and short-stroke engines of the same capacity. The overall crankshaft length, therefore, is also settled, since the bearing lengths should be proportional to the cylinder capacity, which is independent of the stroke-bore ratio. On the other hand, the larger throw of the crank of the long-stroke engine increases the weight directly, while its inherent extra "crankiness" calls for larger dimensions if equal stiffness and freedom from vibration are to be assured.

Then pointing out where the long stroke adds weight, he concludes that as it is far easier to increase output by boring out the cylinders than by increasing the stroke, the case for the short stroke motor is proven.

I am confident that a restudy of the stroke-bore ratio problem will result in a reaction toward the short-stroke engine, with all its unquestioned charm of sweet running and flexibility. From the point of view of lightness, efficiency and power per weight, it is significant that the latest aeronautic practice should have broken away so completely from the long-stroke superstition by which aeronautic engine design was held in thrall only a few years ago. What is good in principle for aeronautic engines is also good practice in general so far as it can be applied. Above all, the lessons to be learned from the aeronautic engine which are of general application, is that of the proved fact that the short-stroke engine compares favorably with any other type. Because of its inherent lightness and reduction in quantity of material required, it is also economic in the fullest sense, another happy example that the best may be the cheapest.

The short-stroke engine has particular claims to attention from the designers of eight-cylinder car engines. The trouble with such engines is that they involve considerable overall width and can only just be packed into a hood which will conform with the body lines. Even then it is not possible to adopt the high hood which, with suitable treatment, can be made so charming in appearance and to harmonize so well with modern body design. The short-stroke engine permits this desirable end to be realized. It should be remembered that for a given ratio of connecting-rod to crank length, say 2¼ to 1, a 1-in. increase on the stroke means at least 1⅝ in. on the overall height; ½ in. on the crank-throw and a 1⅛-in. lengthening of the connecting-rod centers.

In the case of an eight-cylinder engine of 3¼-in. bore and 5-in. stroke, with connecting-rods two and one-third times the crank length, the pistons being 1.6 in. from piston-pin center to crown, the distance from crankshaft center to piston crown is 15.6 in., or say 15.5 in.

With cylinders of 3.75-in. bore and 3.75-in. stroke, or approximately the same capacity, the same connecting-rod to crank ratio and the height from piston-pin to piston crown ⅛ in., we have the distance from crankshaft center to piston crown 12,475 in., or say 12.5 in.

With the same figures as above but using secondary balancing, allowing a connecting-rod to crank ratio of 1.9, we have 10,800 in., or say 10¾ in.

The approximate saving in overall width in an eight-cylinder engine, with cylinders at 90 deg., is obviously two and one-half times the saving in height given above, so that the second case would save 4¼ in. overall width over the first, and in the last case the overall width would be reduced by not less than 6¾ in. Designed upon these principles, one of the most serious objections to the eight-cylinder engines goes by the board, and it becomes possible to house it under the same well-shaped hood as now accommodates a four or six-cylinder engine.

Cleanness of design, both outside and in, is being appreciated more every day. The day is rapidly approaching when the public will demand that the automobile shall not be a means of transportation only, but susceptible of artistic treatment in just the same degree as a yacht or a house. The first law of beauty in construction of any kind is that the part shall be the one best fitted to the purpose. In this is postulated a fundamental natural economy, since it implies that excess of material or complication must be avoided.

Some day, perhaps the eight-cylinder car builders will put their heads together and work out a design that will satisfy the aesthetic tastes already inculcated by the six, and embark upon a new and interesting phase of the battle of the cylinders. And when the eight-cylinder car builders have done so and evolved a car that looks thoroughbred rather than cross-bred, it will be interesting to watch the developments of six-cylinder car builders who have been helped as much by the appearance arising from the use of six-cylinder engines as by their intrinsic merits.

Airplane Communication Services in the Adriatic

The Societa Industrie Aeronautiche e Meccaniche d'Italia Centrale (Siamic) at Perugia has presented to the National Department of Aviation a complete project for airplane communication services in the Adriatic. The proposed lines will be operated between Ancona, Pola and Fiume; Fiume, Zara, Sebenico, Spalato, and Lissa; Lissa, Metcovic, Ragusa, Cattaro, Scutari, and Durazzo; Durazzo Vallona, and Corfu; Corfu and Brindisi. These trips are to be made twice a day from south to north.

The Siamic Co. intends to use army airplanes duly accommodated for transportation of passengers and merchandise.

There are 1,200 motor cars licensed in Siam, and about 800 in daily use. Of the 170 imported in the last fiscal year the United States sent 160.

A new oil gusher discovered in Alsace yields 30 tons of oil daily.

The Regulation of Automobile Headlighting

How Early Difficulties in Headlight Regulation Enforcement, Due to Unscientific Restrictions, Have Been Overcome, Experiments Which Indicate Compliance with Present Laws and Possible Improvements in Them.

BOTH from a public and from an engineering standpoint, every motorist, present and prospective, and everyone not actually opposed to motoring, is interested in the broad general subject of proper automobile headlight regulation. Furthermore, lawyers and legislators not necessarily either motorists or friendly to them, are deeply interested in this important subject. From a public point of view, those concerned are the users of the highway, on foot or in motor cars, also in or on other vehicles. From an engineering standpoint, the whole question is a problem in illuminating engineering and should be dealt with as such.

In the days when the headlighting of automobiles was done by acetylene gas, the headlighting problem was not what it is to-day. Acetylene headlights gave a rather limited illumination on the road, and at the same time did not produce the intense and blinding glare with which we have unfortunately become familiar since the advent of the electric incandescent lamp as a source of light for this purpose. The incandescent lamp with highly concentrated filament, when used at the focus of a parabolic reflector throws a beam of very high intensity—a beam which is capable of giving an excellent driving light, but which under many conditions produces an insufferable and intolerable glare dangerous to the other users of the highway.

Inefficiencies of Early Legislative Control.

As a result of protest against the dangerous glare of powerful headlights, legislation has been enacted from time to time for the purpose of controlling the use of such headlights. The exact method of control which should be adopted had to be devised as an entirely new matter, and hence legislative enactments were in the beginning very broad and indefinite. In general the laws stated, and do yet state, that headlights should not produce a dangerous glare or dazzle. Legislation of this character, however, had very little effect in eliminating the evil inasmuch as neither the legislators nor the traffic police officers nor the public knew what were the necessary means to adopt to accomplish this elimination of glare while retaining the light necesasry for the safety of all users of the highway. To make the provisions more definite further legislation has been passed requiring that no portion of the direct reflected beam of the headlights, when measured at a distance of 75 feet or more in front of the vehicle, should rise more than 42 inches above the level surface on which the vehicle might be standing. In some states it was provided that state officials should pass judgment on various types of headlighting equipment and should approve or disapprove them in accordance with whether they meet the above requirements or not. The difficulty which was met in the case of this type of legislation was that it is practically impossible to say what the limits of the direct reflected beam are. With certain types of headlight glasses, namely, the scattering or diffusing type, the beam is broken up, so that the portion which comes by reflection is indistinguishable from the portion which proceeds from the lamp itself. Makers of this type of device have claimed that there is no direct reflected beam, a claim which evidently leads to an absurdity. Furthermore, the difficulty arises that if all of the direct reflected beam from headlights were cut off at a level 42 inches above the road, it is doubtful if the remaining light above the 42-inch line would be sufficiently strong to enable the driver to proceed with safety to other users of the highway. The judgment of administrative officials under this proviso was in general arbitrary and personal, had no scientific basis, and hence no basis on which uniformity of judgment could be founded. In general this type of legislation has been found ineffective.

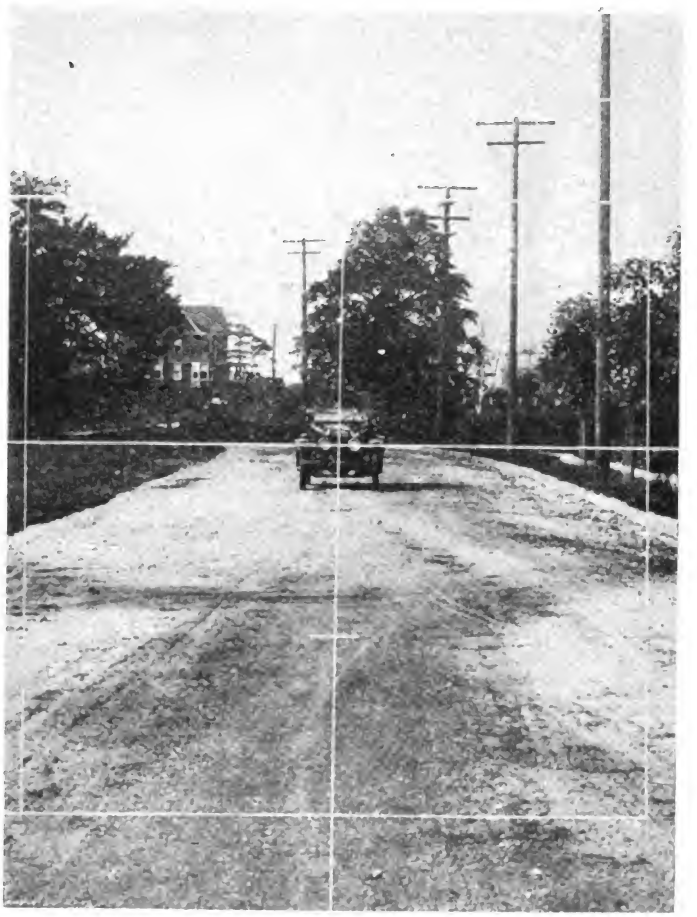

Fig. 1. Car 200 feet away.

Varied Interpretations of Present Laws.

There have been some attempts to reduce the matter to a scientific basis. In St. Louis, as a result of a decision reached that headlights of more than 1200 candlepower

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**The authors are connected with Electrical Testing Laboratories, New York.

would produce dangerous glare, a huge photometer was built and set up in such a way that a car could be placed in front of it and the beam of the headlights measured to

Fig. 2. Car turning out to pass.

see whether it came above or below 1200 candlepower. If it came below, the headlights were approved. In the Province of Ontario, as a result of certain experiments, the glare limit was fixed at 800 candlepower. In Vermont, the University of Vermont conducted experiments on headlights, but it is not evident from their report that approvals of headlighting devices were based strictly upon the findings of their tests.

Matters were in this state when the Illuminating Engineering Society appointed a Committee on Automobile Headlighting Specifications. The work of this committee which has been directed toward the formulation of specifications for acceptable headlighting devices will be described in some detail. This committee decided that the first thing to do was to get some line on how much light is necessary to comply with the general provisions of a headlighting law. At the time New York State was just in the process of revising its legislation on these lines, and the New York State Law was taken as a point of departure. This law provided in brief that the headlights must render visible a person, vehicle or other substantial object 200 feet directly in front of the car, and that no dangerous glare or dazzle should be produced. The committee therefore decided as a first step to make experiments which would give some information as to the limitations of the light required to comply with the provisions of the law. In the first place, how much light is necessary to render visible an object 200 feet directly in front of a car, and second, what is the limiting value of the beam in a driver's eye beyond which the glare becomes intolerable?

Recent Lighting Experiments.

Experiments were conducted on a dark road. A pair of headlights arranged with a storage battery, a rheostat and an ammeter were set up on this road, and back of them a seat representing the driver's seat. A similar pair of headlights similarly equipped were set up to the left of these 100 feet down the road, the rheostat, however, being under the control of the person occupying the driver's seat behind the first headlights. About fifty observers were employed, these being illuminating engineers, automobile engineers, private car drivers, chauffeurs, traffic officers, state officials and others, all of them competent to form intelligent judgment on the question at hand. The operation was as follows:

The observer sat in the driver's seat and adjusted the rheostat of the lamps in front of him until he had sufficient light to see men walking across the road 200 feet away. The value of the light so required was determined. Maintaining the light at that value, he switched on the other pair of headlights facing him and adjusted their brightness until he reached a point where he considered that any further light would produce a glare beyond the limits of toleration. The light reaching his eyes under those circumstances was also measured.

A study of the fifty sets of entirely independent results so obtained revealed, as was to be expected, very wide variations. For purposes of visibility the lowest man wanted 1,200 candlepower and the highest 18,000. With respect to glare the lowest man would stand but 80 candlepower, while the highest accepted 800 candlepower. Of course, these were personal judgments, but the results tell us what we want to know, for the definition of a satisfactory headlight depends largely on the driver's own

Fig. 3. Car at 100 feet in passing position.

idea of what he wants, and so the data so obtained, while referring only to stationary lights, and while showing marked inconsistencies, were of great value.

Headlight Acceptability Tests.

About this time the Secretary of State of New York applied to the committee for specifications under which acceptability tests of headlighting devices might be made for him as provided in the law. In order to arrive at the limitations which must be incorporated in such specifications, the committee did not consider that the results of the stationary test were sufficient, but proceeded to inaugurate running tests in which two cars were used similarly equipped and in which the beam was studied photometrically. As a result of numerous running tests with varied beams and with skilled observers the conclusion was reached that for the purposes of a legally restrictive specification the values which had been found as outside values in the stationary test might be adopted. That is to say, it was clear that the beam down the road should not be less than 1,200 candlepower, which was the requirement of the lowest man in the stationary test. It was also evident that the glare reaching the eye of an oncoming driver at a distance of 100 feet should not be greater than 800 candlepower, which was the highest glare value accepted by any of the observers in the stationary test. Therefore, with these values fixed, a specification was drawn requiring a candlepower in the beam between the horizontal and the road level 200 feet from the car not less than 1,200 candlepower, also restricting the beam at a point 100 feet in front of the car, 7 feet to the left of the axis of the car and 60 inches above road level to 800 candlepower. It was also provided that the

Fig. 4. Fig. 1 with beam produced by prismatic front glasses.

candlepower directly in front of the car and 60 inches above the road level should not exceed 2,400. The reason for the adoption of these positions for measuring the glare are as follows: If 800 candlepower is the limiting value for tolerable glare at 100 feet, as the distance becomes greater this value can be increased. For instance, the corresponding value at a distance of 200 feet would be four times as great or 3,200 candlepower. It was considered, therefore, that directly in front of the car a

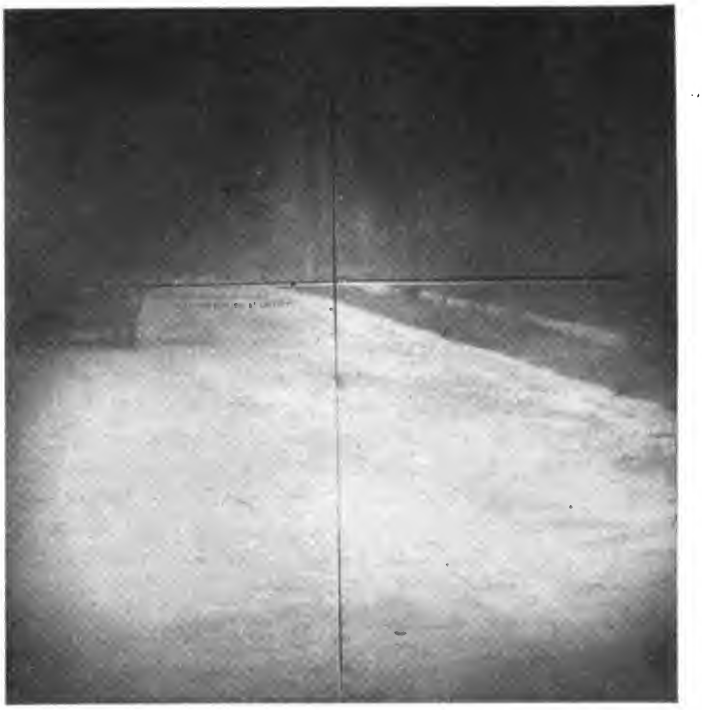

Fig. 5. Fig. 2 with beam produced by prismatic front glasses.

higher value than 800 could be adopted, because an oncoming driver would never be directly in front of the car at as short a distance as 100 feet. Therefore the value of 2,400 candlepower was allowed. At a distance of 100 feet the on-coming driver must have turned out to pass. His eye, therefore, may be assumed to be approximately 7 feet to the left of the axis of the car and at a distance of 60 inches above the roadway, and at this point the light is restricted to 800 candlepower. It will be noted that a height of 60 inches is chosen, which is a representative height for the driver's or pedestrian's eye above the road level rather than 42 inches, which is a figure of no particular significance.

Specifications including these limits were adopted by the Secretary of State of New York after a public hearing in which the various interests were represented and presented their views. Since that time the State of California has adopted the same values.

Recommended Alterations in Headlight Specifications.

The Committee on Automobile Headlighting Specifications has never been satisfied that the value of 1,200 candlepower for the driving light is sufficient, and at the time of the adoption of the 1,200 candlepower figure the members went on record as favoring a higher value which, however, it was believed inadvisable at that time to put into the specifications. Since that time the committee has definitely recommended that the driving light should be four times as intense, namely, 4,800 candlepower as the minimum. It has also recommended that headlighting specifications provide for a proper spread of the beam toward the right of the axis of the car; this for the purpose of revealing pedestrians on the road and of showing the curb and ditch. Its later recommendation, therefore, includes the proviso that 7 feet to the right of the car and 100 feet ahead there must be a minimum of 1,200 candlepower. The State of Connecticut has adopted

these latest recommendations of the committee and has made its acceptability tests in accordance with them. The State of Pennsylvania has adhered to the New York State practice, excepting that it has improved upon it by requiring that 100 feet ahead of the car and 7 feet to the right there must be a minimum of 800 candlepower, a proviso which is in accordance with the committee's ideas. but which does not go quite so far as the committee would like to go.

It should be understood and borne in mind that these specifications on the part of the committee are not intended to describe the best headlighting practice. They are intended to be applied to the restrictions applied by administrative officials and are drawn with the idea of working a minimum hardship upon those who already have made an attempt to comply with the requirements of the situation. Hence many devices which from the point of view of the illuminating engineer or of the electrical engineer or of the mechanical engineer are decidedly inferior, are capable of complying with these specifications. However, a strict compliance with them will insure that devices producing a really undue glare will be ruled off the road, and conditions to this extent will be greatly improved. Those who are using devices which, while they do not produce an undue glare, also do not produce good driving light, will after a time come to find that they are at a disadvantage by the use of such devices and will exchange them for better ones; that is, the bad devices will be ruled off the road, the fair to middling devices will gradually disappear, and it is reasonable to expect in time that motor cars will light the road reasonably well both from the point of view of the driver and from the point of view of others. One effect of the specifications is to encourage the efficient devices; that is, those which throw the light on the road where it is wanted and not over the entire surrounding scenery where much of it is wasted.

Model Headlight Law.

The committee further in connection with the Committee on Lighting Legislation of the Illuminating Engineering Society has prepared a proposal of a model headlight law. This proposal contains a number of very interesting and important suggestions, one of which should be of great interest to motorists. This is that testing stations should be authorized or licensed, where the headlights on any car could be tested for a nominal sum. Garages, for instance, might undertake this work after having convinced the authorities that they have the necessary equipment and technical knowledge. Then traffic officers should be authorized to stop a driver whose lights appear to be glaring and to give him a summons to appear at one of these testing stations to have his lights tested within a certain time. This should have the effect of eliminating from the road all cases of glare excepting such as result from willful disobedience of the law, and those cases could readily be dealt with by ordinary legal processes.

It should be clear from the foregoing that a start has been made on the regulation of automobile headlights along scientific lines. With four states approving headlighting devices as a result of scientific tests made under specifications which are fundamentally the same, a beginning has been made toward interstate standardization, which is a matter very greatly to be desired. Every state which adheres to this method adds a good deal to the accumulated results. It is to be hoped that through the influence of the various automobile associations, future legislation may be guided along these lines. It is only by adherence to scientific methods based on fundamentally correct experimental results and representing a satisfactory engineering compromise between the demand for more light and the demand for less glare that sound and permanent results are to be expected.

Effects of Prismatic and Scattering Lens.

To demonstrate the points made, see the illustrations which show, first, the appearance of a car on the road 200 feet away, Fig. 1; second, a car turning out to pass another car—under this condition the headlights of the car are pointing at a considerable angle from each other,

Fig. 6. Fig. 3 with beam produced by prismatic front glasses.

Fig. 2; third, a car 100 feet away in the passing position, Fig. 3. On the screen image of each of these slides was thrown the beam from an automobile headlight and this beam was modified by tilting the lamp, by putting on a prismatic front glass, and by putting on a scattering front glass. Figs. 4, 5 and 6. The results showed that the unmodified beam when placed horizontal would throw a bright light in the on-coming driver's eyes. The unmodified beam tilted would avoid this glare, but produce an insufficient light at the sides of the road. A prismatic front glass would divert the light toward the road, giving good road illumination and keeping down the glare and at the same time illuminate the sides of the road. A scattering front glass would produce a light more or less uniformly distributed over all objects in view.

Discoloration of casein used in glue on heating to 212 deg. F. is due to the presence of lactose, and indicates that the curd was not very thoroughly washed. Absence of such color change indicates well washed curd, except in the case of natural sour casein precipitated from very sour milk. No discoloration is then noticed because all the lactose has been converted into lactic acid.

Electrically-Heated Tubing for Automobile Drive Shafts

New Process Which Heat-Treats Light Wall Tubing so Its Resultant Strength and Toughness Permit Its Use for These Important Parts

ONE of the difficulties in improving the quality of steel tubing in any heat-treatment process, granting the desirability of such treatment for light wall tubing tubing on a commercial basis, has been that the tubing, after being heated up to proper temperatures by the ordinary methods applied to other steel products and then quenched, has been distorted so as to be unfit for the use intended. By an ingenious application of electricity as the heating medium, this and other objections have been overcome by the company mentioned.

The new process was developed as the result of a search for a method of heat-treating steel tubing to be used as the shafts for lances for the Russian cossack cavalry. This was early in the war. Because of certain market conditions the only steel obtainable was a soft welded steel tube 1 in. in diameter, 20 gage and of 0.35 per cent carbon. In the finished lances an elastic limit of over 83,000 lbs. per sq. in, was required to obtain a high degree of stiffness. The length of these tubes being 10½ ft. and extremely light, it was not possible to properly treat them vertically in any fuel-fired furnace.

The evolution of the process to its present commercial application is recounted as follows by H. P. MacDonald, vice-president of Snead Co.:

A plan was developed for employing an electric current of low voltage and high amperage to heat the tubing by its own internal resistance and an apparatus was designed to accomplish this. The tube was held in a vertical position between copper contacts, which gripped it at its upper and lower ends, the upper contacts being fixed vertically and the lower ones free to move up and down with the tubing, the latter being brought to the same initial position for the start of each operation by a treadle and positive stop. The contacts were gripped by powerful springs and opened by cams attached to a vertical shaft. The current was led from a low-voltage transformer to the uppsr and lower contacts and the tube heated by its passage in about 20 sec. On reaching the required temperature the contacts were opened and the tube allowed to fall vertically into a deep bath of oil situated directly underneath the machine. This process proved very successful.

On this machine no attempt was made to measure temperatures accurately, the elongation for a given temperature being figured out and the electric current shut off by a mechanically operated switch was tripped when the desired enlongation was reached. It was observed, however, that the temperatures necessary for hardness were much lower than those required when a fuel-heated furnace was used, and in an endeavor to learn the cause for this I met Prof. James S. Macgregor of Columbia University, New York, who was looking for means to heat treat a lot of aircraft tubing for the Italian Royal Flying Corps. As a result a large quantity of tubing of various diameters, in lengths up to 22 ft., was heat treated satisfactorily, no difficulty being experienced in keeping the tubing straight and the process taking place so rapidly that the tube was not sealed. During this time the apparatus was being gradually improved and it was discovered that when the critical point of the material was reached the tubing, instead of continuing to expand, actualy shortened in length, thereby indicating in itself the critical temperature, and means were devised for multiplying the movement and indicating the temperature on a dial.

Later on further improvements were made, such as hanging the upper contacts to cables passing over pulleys at the top of the machine, connecting these cables with a drum at the bottom and having the latter connected through spiral gearing so as to change the point of leverage on the temperature-indicating pointer in such a way as to make the movement of the pointer constant for all lengths of material undergoing the same temperature change.

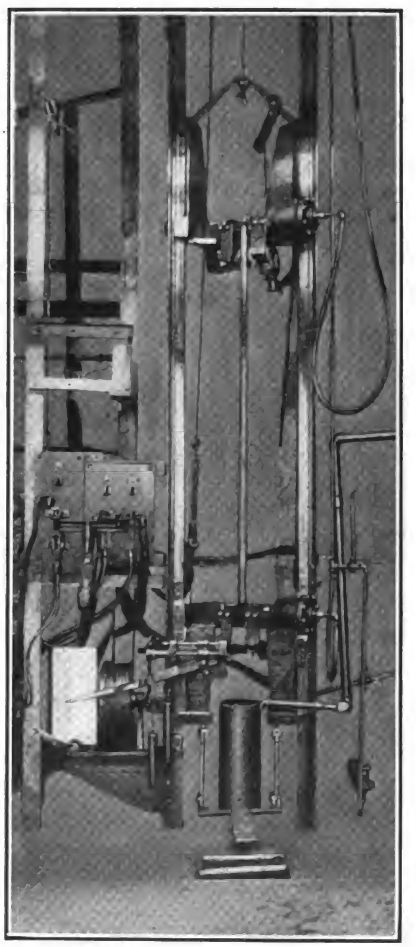

Fig. 1. The electric heat-treating apparatus developed by Snead & Co. for treating light wall steel tubing. Temperature changes are recorded on the dial in the lower left-hand corner.

About thils time work was also done for the United States Bureau of Standards, which was developing wing beam structures for all-steel airplanes, and tests on samples cut from a chrome-vanadium steel beam of about 0.25 per cent carbon and 0.018 in. thick showed the following results:

Proportional limit, lb. per sq. in.	11.000
Ultimate strength, lb. per sq. in.	218,000
Elongation in 2 in., per cent...	2.7
Scleroscope hardness	75

These beams could be cut with a hacksaw after heat treatment.

A large quantity of steel tubing for use in landing chassis of Handley-Page airplanes was also put through this process with complete satisfaction to the Government inspectors, who required an ultimate strength of 110,000 lb. per sq. in. and an elongation of 15 per cent in 2 in.

Samples of 3.50 per cent nickel steel axles submitted to the Dayton-Wright Airplane Co. gave these results:

Elastic limit, lb per sq. in.	Ultimate strength, lb. per sq. in.	Elongation in 2 in., per cent
154,000	172,400	6.5
198,600	223,500	6.0
220,500	246,000	6.5

When the war ended we were working with the engineering division of the Air Service conducting tests on round steel tubes to be used as interplane struts. The tests developed the interesting fact that the ordinary column formula failed to hold in steel of such high tensile strength. In the case of a tube having an ultimate strength of 193,000 lb. per sq. in. the compression results were 12 per cent higher than the strength computed by the formula, which checked out very closely on ordinary materials.

In the machine as it is now used the work is held in copper contacts operated by compressed-air cylinders and the temperature is indicated on the dial at the left, as shown by one of the illustrations, the pipe containing the quenching oil being shown projecting above the floor of the shop. The present type of machine allows the critical temperature of the material being treated to be determined readily while the work is in process, especially in the case of high carbon or alloy steels in which there is a very definite retrograde movement of the pointer when the calescent states of the material are reached. It has been found that these critical periods occur under electric treatment at very much lower temperatures, that is, from 50 to 100 deg. Fahr., than when the ordinary furnace treatment is used. It is not, however, necessary is required. Solid bar stock takes about 0.06 kw. hr. per lb.

Previous experiments showed that where the material was quenched before the pointer showed the temperature beginning to increase again, the results were uncertain, and to obtain proper quenching conditions the old idea of "quenching on a rising temperature" had to be followed The tests show that after the needle has once begun to indicate an increase in temperature after the drop at the critical point, practically the same results are obtained until the maximum temperature, reached before entering the critical period. is passed. After this there is a tendency for the grain of the steel to coarsen. These tests also indicate that a single quench on nickel steel heated electrically gives as good results as the double.

The importance of completing the allotropic changes in the structure of the steel taking place in the critical period is too well known to be more than mentioned, and these figures illustrate the amount of internal work that must be accomplished, neglecting the factor of radiation. In other words, 30 per cent of the total heat units necessary to put into this steel go into it after it has reached its maximum temperature and is passing through the critical period and before the temperature again begins to rise. Additional investigations are desirable along these

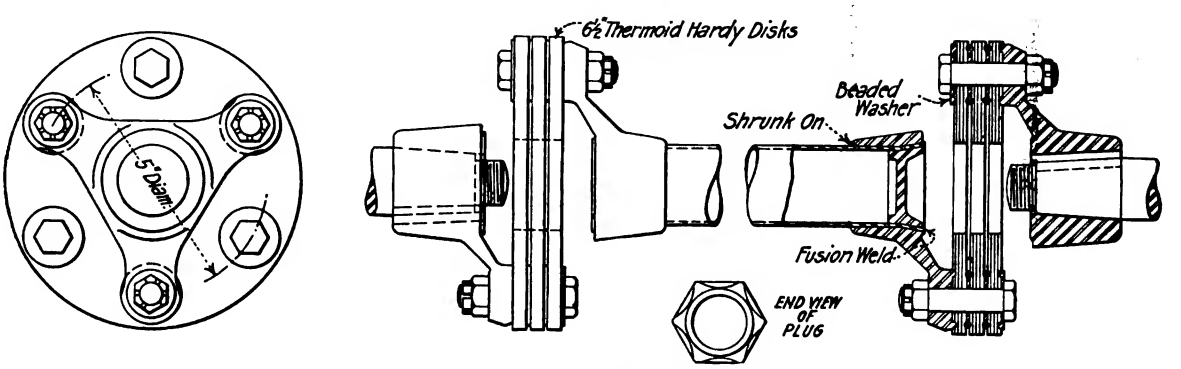

Fig. 2. How the Snead cushion drive is applied to automobile shafts. A specially constructed universal joint is a feature of this new departure.

in the use of these machines to know beforehand the critical temperature as it is automatically determined in the process.

The advantages of this method seem to lie in the low temperatures necessary, speed of the heating operation which is usually a matter of less than one minute, thereby in most cases completely obviating the formation of scale and making possible the heat treatment of extremely light material, the complete control of the work and the high physical characteristics obtained, the reduction in area of the test pieces being particularly noteworthy. The process is also useful for discovering flaws or thin spots in the material undergoing treatment, this being particularly applicable to tubing, where any irregularity in the wall is shown up by that part overheating or heating more quickly than the other portions of the tube.

Three volts per foot of length of the material to be heat treated are found ample for any analysis, and a current density of 8,000 amp. per sq. in. in cross-section is usually employed at the start of the process. The voltage between contacts increases as the temperature of the material goes up and the amperage correspondingly falls, the figures given being for the amperage taken at the first rush of current. In general practice for tubing, 0.1 kw. hr. per lb. of material heated up through its critical state same lines, particularly with reference to chrome-nickel and carbon steels.

A most interesting application to the automobile industry of nickel steel tubing, treated by this process, is the latest development in this field. It is the use of such tubing as propeller shafts for passenger cars and trucks.

In the average propeller shaft a carbon steel tubing, untreated, is the main part, coupled to the universal joints in the usual manner. It is evident that the use of an electrically heat-treated nickel steel tubing in such shafts, is a source of distinct advantage. In the first place there is decidedly increased strength, the nickel tubing after the treatment having several times the tensile strength of the carbon tubing, even if it were heat treated. The automobile builder can readily appreciate this factor in the added stability of the motive power.

An important claim made for this kind of shaft is that its strength and toughness are such that under no conditions will the shaft whip.

An ingenious method of attaching the propeller shaft to the spiders is a feature, Fig. 3. The tubing is inserted cold into the center of the heated spider, which is so constructed that the counter-sunk position of it is hexagonal in shape. As soon as the tubing has been inserted properly, its edge only is heated to a cherry-red tempera-

ture by an oxy-acetylene flame. An hexagonal cap or sealing wedge of steel is then driven into this opening with a pneumatic hammer and the outer edges arc welded. The process is claimed to insure an unusually strong union of the shaft and spider, but there is the added advantage that the nickel steel tubing is in no manner harmed by the heating of the tubing in order to attach it to the spider. The line drawing, Fig. 2, also further explains this procedure.

The method ot connecting these propeller shafts to the propelling portions of the car is interesting. Instead of the usual universal joint, there is used a device consisting of three Thermoid-Hardy discs separated by beaded washers and attached to both ends of the propeller shaft as indicated by the illustration. The use of this Snead cushion drive is claimed to insure remarkable steadiness in operation as well as unusual strength and resistance to shock.

With reference to this method of separating the fabric discs and the plan for separating them, careful tests have been conducted to determine the best of the various methods. The tests have shown that the most desirable results are obtained by having the spider feet, flat surfaces, where they come in contact with the discs with a single bead raised around their outer edge, the spacing washers which go between the discs, where one or more are used, and the washers that go under the head of the bolt are similarly shaped. This brings the pressure of the bolt to bear on the enlarged diameter of the grip at some little distance from the bolt and in such a way that the tendency is to hold the material under the washer rather than to squeeze it out. Furthermore, this beaded edge construction insures against cutting of the discs by sharp corners. This combination has resulted in a propeller shaft of extreme lightness, enormous strength and remarkable resiliency and we find that through the employment of light gage, highly tempered steel tubing, the angular torsion occurring in the tubular shaft results in an even greater cushioning effect than can be obtained in the tubular shaft by the use of fabric discs, so that the benefits to a motor vehicle using Snead Cushion Drives are far greater than any other type of propeller shaft.

The advantages claimed are that no oil, grease or other lubrication is necessary; there is no noise or clattering; the construction is both lighter and stronger; it results in easier riding and longer life; it acts as a shock absorber inserted in the drive shaft, cushioning or absorbing shocks from either direction; it saves repair bills and replacements, and the combination of longer life, lighter weight and no repairs reduces the running cost of the car or truck to its owner.

These qualities have appealed with sufficient force to vehicle manufacturers so that ten motor car manufacturers and fifteen truck makers have adopted this drive as standard equipment, and incorporated it in the design ot the vehicle produced.

It is believed that the possibilities of this process of heat treating steel tubing have been only partially developed. The cost of handling work by this process is dependent on the available electric current. Heavy sections such as steel rails can be heat treated advantageously, it is asserted, but the success commercially depends on the solution of certain electrical problems. It would be easy to obtain a tensile strength of 130,000 lb. per sq. in. in a rail with 0.70 per cent carbon by this process and there would also result greater reliability than now obtained in the ordinary rolled section. The advantages of the process

Fig. 3. Appearance of the electrically heat treated nickel steel tubing after it has been joined to the spider of the automobile propeller shafts.

are increased by the fact that pyrometers and refractories are not needed and that the method can readily be taught to operators. American and foreign patents have been granted covering all these processes.

Protecting the Open Car From Sudden Rain

Many motorists prefer to keep their car tops down in summer. Summer is the season of sudden rain storms. How often do we see an open car parked beside the curb, the owner in his office or a store or house, the seats so deluged by a sudden rainfall as to make it impossible to use it except at the expense of wet clothing.

Here and there a man has solved the problem in a simple way. A blanket is made of top material—either pyroxylin coated or rubberized. It need not be as heavy material as the top. Making it consists merely of cutting the goods to desired size and hemming the edges. It can be folded and tucked out of the way when not in use. Goods are obtainable from top makers, trimmers and some department stores.

The motorist spreads the blanket over his car while leaving it to enter a building, if there appears to be danger of rain. This saves the time and bother of putting up the top.

Traffic on New York's Fifth avenue is so great that it is proposed now to make it a one-way street. Recent figures show that the average throughout the day is more than 28 vehicles a minute, reaching above 30 a minute at certain hours. Practically 100 per cent of this traffic is motor driven. The street is but 55 ft. wide and this huge traffic is made possible only by the division into six lanes, three northbound and three southbound.

Tokyo Motorbus Co., which began operations the first part of 1919, and now runs 118 passenger buses and 58 motor trucks, has declared a dividend of 6 per cent from its profits.

The Automotive Manufacturer

A consolidation of The Hub and Automotive Engineering

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THE AUTOMOTIVE MANUFACTURER, a consolidation of THE HUB, established in 1858, and AUTOMOTIVE ENGINEERING, established in 1916, is an authoritative journal, presenting everything entering into the construction of automotive vehicles which is new or worthy of consideration by automotive engineers and manufacturers.

Vol. LXII APRIL, 1920 No.1

Our Birthday Issue

IT IS with pardonable pride that we call attention to the fact that this is our birthday issue, inasmuch as it is the first issue of the new or sixty-second year. There are people who are not inclined to mention their age, and others hesitate to mention all of it, but such is seldom the case with a trade paper. On the contrary, publishers of trade journals have been known to resort to the questionable practice of dividing the year into many different volumes, so that after a time the volume number becomes a very large one. From this the false inference is that the paper is very old, and carries the prestige which goes with age in a trade paper.

This has never been done on The Hub, of which Automotive Manufacturer is the successor, as will be apparent from the simple statement that this paper was founded in 1858, or several years previous to the Civil War. As a matter of fact, it was started about three years earlier, but was dropped temporarily and taken up again in 1858, from which time it has been published continuously.

In this respect it ranks as one of the oldest trade papers in the world. This means the papers which have been devoted wholly and exclusively to some trade or industry, and does not refer to professional journals (medicine pharmacy, etc.).

The extent to which this early establishment of the predecessor of Automotive Manufacturer preceded the day of the automobile, airplane, tractor, and other automotive vehicles may be understood best by considering some of the commonplaces of to-day. Thus, the year of establishment, 1858, is also the year in which the Richard Dudgeon steam carriage was built. It was exhibited at the New York Crystal Palace, and ceased to exist with the fire which destroyed that building. This was one of the first of the American steam-propelled carriages, the next of any importance being built in 1863 (two) and 1867 (one).

In this connection it is interesting also to mention that the date of establishment precedes by several years in some cases, and by many years in others, the invention or beginning of many of our most important or most necessary devices. Thus, petroleum (or as it was called then, coal oil) was discovered in 1859. In the same year, the first dwelling was lighted by electricity, and the Great Eastern was launched. The first passenger elevator was produced in 1861, Siemen's dynamo-electric machine in 1867, the Sholes typewriter in 1868, the first air brakes for railroad use in 1869, Bell's telephone in 1876, Edison's phonograph and the Otto gas engine in 1877, Remington typewriter in 1878, Faure's storage battery in 1880, Mergenthaler's linotype machine in 1884, Cowles' process of making aluminum and the first electric railway in the United States in 1885, the kodak in 1888, acetylene gas from calcium carbide. Krupp's armor plate and Linde's liquid air in 1895, and Marconi's wireless telegraphy in 1896.

By simple subtraction, it will be noted how the pioneer vehicle publication preceded these. And yet, it is just entering upon its greatest period of usefulness in the vastly increased field.

Farmers as Motor Truck Users

WHILE truck manufacturers have at times thought of the farmer as a prospective customer, the extent to which farmers have bought trucks in recent years has not been realized. Thus, it will doubtless surprise many in the industry to know that one-sixth of the total number of trucks in the State of Pennsylvania are owned by farmers and are used daily on farm work. The precise figures are: Total for state, 64,200; farmers, 10,250. More than this, the farm use of motor trucks is increasing more rapidly than other uses, if we can judge by the figures for the past 12 months. In the state just mentioned the increase from January, 1919, to January, 1920, was exactly 31.8 per cent. While the latest figures for the country give an indicated 37 per cent increase, this is based on a very rough estimate for the previous year. It requires only a difference of 20,000 in this earlier estimate, or approximately 2 8 per cent, to reduce the increase below that given above for the farmers.

This will surprise many, but it will be a further surprise to know that of all the farms in the state, a large number of them in very hilly or mountainous sections, nearly 5 per cent have motor trucks. It is interesting to note how the percentage of farms with trucks increases with proximity to the larger cities, presumably because of the daily visual evidence of their success in the service of manufacturers and because the dealers will go a short distance out into the country for a live prospect, after which his neighbors automatically become prospects too.

Thus of the counties near Philadelphia, Philadelphia county farmers are 35.7 per cent equipped with trucks, Delaware county 17.6, Chester county 8, and Bucks and Montgomery each 6 per cent. The same is true of the counties near Pittsburg, Reading and other large cities.

If the same percentage be applied to all the farms in the country, 6,400,000 in round figures, this opens up a field for 320,000 motor trucks. And considering the percentage of increase in Pennsylvania in the last year applied to the country, means adding 101,000 each year.

Glues and Veneers in Aircraft Work

By. Lt. H. A. Gardner, U. S. N. R. F.

MARINE GLUE is used to apply muslin between the inner and outer skins of pontoons or floats. It is required to be of a sticky, viscous nature and relatively non-drying and elastic. It is usually composed of pine tar, rosin, manila rosin, and alcohol.

Effect of light on glue: A recent request was made for information relating to the effect of ultraviolet light on the glue that is used in laminated wood parts. It is believed that the possibility of destructive action from this source is remote under ordinary conditions. Tests, however, have been arranged to determine the permanence of glues when subjected to various strong light conditions. It should be noted that on pontoon and hull construction where plywood is used, the old method of finishing with varnish would allow the admission of light rays. Since the bureau has lately abandoned this method of finishing and adopted the use of opaque gray enamel having antiactinic properties, there should be no appreciable admission of light rays.

Spar glue: Some tests have recently been made to determine the value of spar glue that has been in use for some time by makers of oars. This glue has been produced from a mixture of two parts of hide glue and one part of linseed oil, with the requisite amount of water. Such glues, however, should be considered simply as water resistant and are not waterproof. Joints made with them are sometimes readily separated when acted upon by water.

Waterproof glue: Attempts are being made to use waterproof casein glue as a cold glue for various wood parts, in place of ordinary cold glue or hot hide glue. It is probable that successful results will follow if the glue is carefully selected and prepared. In several foreign aircraft factories casein glue is now used successfully on various wood parts such as cap strips. It is mixed as needed, usually with an equal quantity of water.

Some recent investigations at the Forest Products Laboratory on the subject of waterproof glues have developed data of value to the aircraft manufacturer. An investigation of a casein glue in use by a piano manufacturer, Bush & Gertz, Chicago, Ill., included tests on veneer panels. The following is taken from the report of the tests.

"On January 28, 100 grams of this casein glue were soaked for three hours in 300 grams of water. Then 50 grams of lime were added to the glue. a, 100 grams casein and 300 grams water; b, 50 grams calcium oxide and 150 grams water; a × b = Glue.

"The glue was very viscous but of uniform appearance. A brush was used to apply glue to panels. The panels were in the cold press one hour at 100 pounds pressure per square inch. The results of the tests are as follows:

Panel marked	Faces and Cores	After 24 hours Boiling	Drying
A	1/16-in. poplar	O. K.	O. K.
B	1/16-in. walnut	O. K.	O. K.
C	1/8-in. walnut	O. K.	O. K.
D	1/16-in. gum	O. K.	O. K.
E	1/16-in. maple	O. K.	O. K.
F	1/16-in. ash	O. K.	O. K.

The Forest Products Laboratory has also developed a special casein glue and is ready to demonstrate the process of mixing this material to panel manufacturers. Carefully selected casein and proper control of the mixing should be observed to obtain the best results. Strength, cheapness, availability, and water resistance constitute some of the advantages of this glue. Arrangements will probably be made to have some glue manufacturer prepare the material on a commercial scale to those who require a waterproof glue.

The Forest Products Laboratory also has a formula for blood albumen glue, that has given satisfactory results on plywood. The Laboratory is prepared to demonstrate to plywood makers the process of mixing the glue base (granular blood albumen) which is now readily obtainable commercially. For its use there is required hot press plates and special apparatus of an expensive nature. It is also understood that such apparatus is difficult to obtain at this time.

Veneer tests: In a report on veneer tests, the Forest Products Laboratory records the exposure of panels glued up with various glues, to the action of fresh water, salt water, gasoline, and engine oil; to boiling and soaking tests, and to various conditions of atmospheric humidity. The action of gasoline and engine oil was much less than the action of fresh water in soaking tests. There seemed to be no difference between the effect of salt water and fresh water on the panels. It was found that glued up panels which successfully stand eight hours' boiling followed by a subsequent drying without showing deterioration, will also stand twenty-four hours' baking. Hence for inspection purposes the boiling tests have been limited to eight hours, and this requirement has also been adopted for plywood specifications. This test is equivalent to a 10 day cold water soaking test and is used in place thereof as an accelerated test to expedite inspection.

Exposure of panels (that have withstood the above boiling test) to the weather and to high humidities, even though unvarnished, have given satisfactory results. Panels glued with non-waterproof glues and protected by a sufficient number of coats of a high grade varnish have also withstood considerable exposure.

Two Danish airplane companies have applied to the Danish government for permission to establish a regular mail and passenger service between Copenhagen and Warnemunde, Germany. Due to unsatisfactory condition of German railways, the airplane service would be popular.

National Automobile Chamber of Commerce has voiced its opposition to the Towner-Gilette motor vehicle bill which provides state-wide licensing of operators similar to what is now being done in New York. It is contended this would be ineffective except as a source of revenue.

Exports from Ceylon were increased to a remarkable extent in 1919, primarily through the increase in rubber exports from 20,885,382 lbs., worth $7,536,326, to 71,386,377 lbs., worth $24,891,754. The average price, according to these figures, decreased from 36 to 35 cents a pound.

When to Heat Wood Before Gluing

Whether a hide glue joint will be strengthened or weakened by heating the wood before gluing depends on the size of the joint. It is assumed, of course, that the work is being done in a glue room that is warm and not draughty, and that the wood itself is at room temperature. Under these conditions, if the joint to be made is of small area, heating the wood is unnecessary. In fact it may be detrimental, for the warmth of the wood will keep the glue thin, and when pressure is applied too much glue may squeeze out, leaving a starved joint. It is very easy to apply too much pressure to a small area.

In making glue joints of large size (several inches each way), heating the wood before gluing is of distinct advantage. Many experiments at the Forest Products Laboratory, Madison, Wis., have proved that when the wood in large joint work is not heated the joints develop full strength only in spots. Weak spots and even open joints are too frequently discovered.

Uniform high strength in joints of large size may be secured by heating the wood in a hot box for 10 or 15 minutes at 120 to 130 deg. F. just before gluing. The heat from the wood prevents the glue from chilling and keeps it liquid until pressure is applied.

It should be remembered that heating the wood retards the setting of the glue to some extent. In heavy woods, from which the heat escapes slowly, this retarding effect is more marked than in lighter woods. In all species glued cold at the laboratory the time under pressure required to develop full joint strength was less than eight hours. When heated wood was used at least 10 hours were required to develop full joint strength in mahogany, and more than 12 hours in red oak and maple.

Finger Prints and Hide Markings

Inventive science, always quick to widen the scope of any discovery or invention, has applied a system similar to finger printing to animals with important industrial results.

As human beings have different finger markings, so animals of different species have distinctive hide markings. These markings are used by manufacturers of leather substitutes for a very important purpose—that of embossing their fabrics with the grain of any hide it is desired to imitate.

The embossing plates are made from the genuine hides direct by a modified electroplating process which exactly reproduces every line, pimple and pore of the hides. The plates, either in flat or cylindrical shape, are applied with great pressure to the material to be embossed with a result so closely approaching leather itself that only an expert can tell the difference.

Tars, Lacquers, Chemicals from Blackboy Tree

One of the most peculiar trees in the world, with an equally peculiar and very diversified line of products, is what is known as the "blackboy" tree which flourishes in the state of Western Australia. It is in fact a species of the grass tree and grows to a normal height of seven to ten feet, and is found to be useful for a variety of purposes.

Until recently no attempt has been made to utilize the tree commercially, but a company has now been formed to work and market its by-products. The plant consists of 19 sets of retorts and furnaces, condensers, receiving tanks, etc., and can deal with 100 tons of gum and other material derived from the tree. The company at present employs about 20 men, besides cutters, and among other things being produced are tars (free from harmful acids), tarpaulin dressings, rope tar and sanitary tar, lacquers (such as Japan black), steam and refrigerating pipe lagging, paint for ironwork that requires stoving at high temperature, stains and paints, pitches for marine insulating, phenol, benzol, and alcohols, coke, potash, and pyrogeneous acid. The production of dyes, perfumes, and formalin, and various kinds of varnishes is also planned.

The formation of this company is the outcome of experiments made by the late Henry Lowley, the city analyst of Perth, who devised the methods of extracting and treating the gum, pith, and fiber of the tree.

Hendricks' Commercial Register for 1919-1920

The 28th annual edition of "Hendricks' Commercial Register of the United States for Buyers and Sellers for 1920 has just been published, after being delayed for two months by the strike of the printers in New York, by the S. E. Hendricks Co., New York. The new edition contains several improvements, the most noticeable being the new method of exterior indexing by coloring the front edge red, white and blue to indicate the different main sections of the book.

First is blue which covers the trades index. The red section is the main classified trades list. The third section of the book as indicated by the white edges contains the trade names under which products are manufactured, with the name and address of the manufacturer. The second blue section is the alphabetical section containing all the names in the book in one alphabetical list with addresses, and their main line of business. This is followed by the index to advertisers. The whole book makes a volume of 2,703 pages.

S. G. V. Motor Car Reorganization

Announcement is made of plans for the reorganization of the S. G. V. Motor Car Co. and for the resumed production of S. G. V. cars at an early date. Lovett A. Grant, who was general manager in charge of production at the S. G. V. factory in Newark, and for the past four years has been engaged in the manufacture and distribution of S. G. V. parts is to head the new company.

Mr. Grant announces that plans of the company provide for the continued manufacture of cars on a quality basis. Distribution will be made at the start only in the larger cities of the country. Temporary offices of the new S.G.V. company have been established at 250 West 54th street, New York City.

Cleaning Grease Off Metals

It seems a simple matter to wipe oil or grease off unpainted or unlacquered metal surfaces, but those who have tried it know it is not; it doesn't come off clean.

Druggists sell an article known commercially as acid dip that will take off grease and leave no streaks, stains or smuts. This is especially well worth knowing by those whose duty it is to keep polished metal surfaces clean and bright.

Machining Two Hundred Cylinder Blocks an Hour

By FRED H. COLVIN*

Unusual Methods and Special Machinery Necessary to Produce the Tremendous Output of Ford Cars Exceeding 3,400 per 16-Hour Day

EVERYONE knows the tremendous output of the Ford factory, but few persons, even skilled automotive executives, realize quite what this big output means in the way of special machinery and special or unusual shop methods. Machining more than 200 cylinder blocks an hour, for instance, or at the rate of more than 3,400 per 16-hour day, makes it imperative to provide rapid and convenient means of handling the cylinder blocks between operations. Fortunately, the block of the Ford motor is comparatively light in weight and can be handled by one man without difficulty. The main problem is to insure a constant supply of castings to the machines as needed, and also to provide means for passing them to the next operation without loss of time or congestion.

Fig. 1 gives a general view of the conveying system used in the cylinder department and shows how a steady stream of castings flows past the milling machines, which perform the first operation. Each cylinder block is mounted on a small four-wheeled truck which is carried by a loosely connected chain so that no difficulty is experienced in rounding the corners, the truck simply making contact with the raised guards on the outside. This conveyor is raised from the floor and supported on uprights so as to pass over the tables of the milling machines and to allow passage underneath where necessary. Rope hoists are also provided for each machine to handle castings, in loading them into place in the fixtures in which they are held. These hoists are supported on the overhead I-beams built up by the uprights and angles as shown.

Some idea of the main operations can be had from the transformation sheet, Fig. 2, in which the numbers correspond to the higher numbers in the article. However, only about a third of the total operations are shown on this sheet. The first machining operation is to mill the four locating points shown at A, B, C and D in Fig. 3. These are projections cast on the top of the cylinder block which are afterward milled off in operation 4. They serve, how-

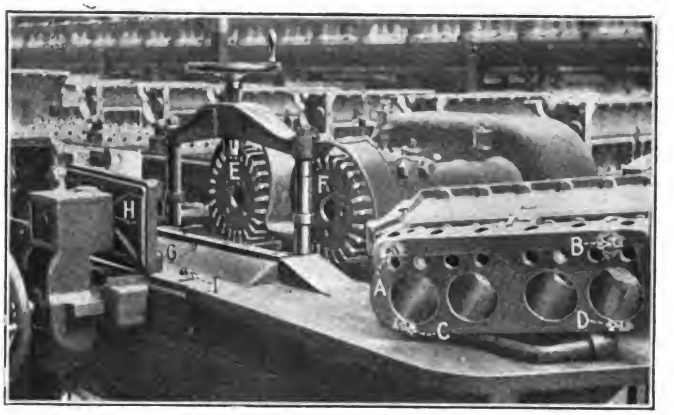

Fig. 3. Milling the four location spots on lower surface.

* Principal Associate Editor, American Machinist. This article is published through special arrangements with Mr. Colvin and the American Machinist.

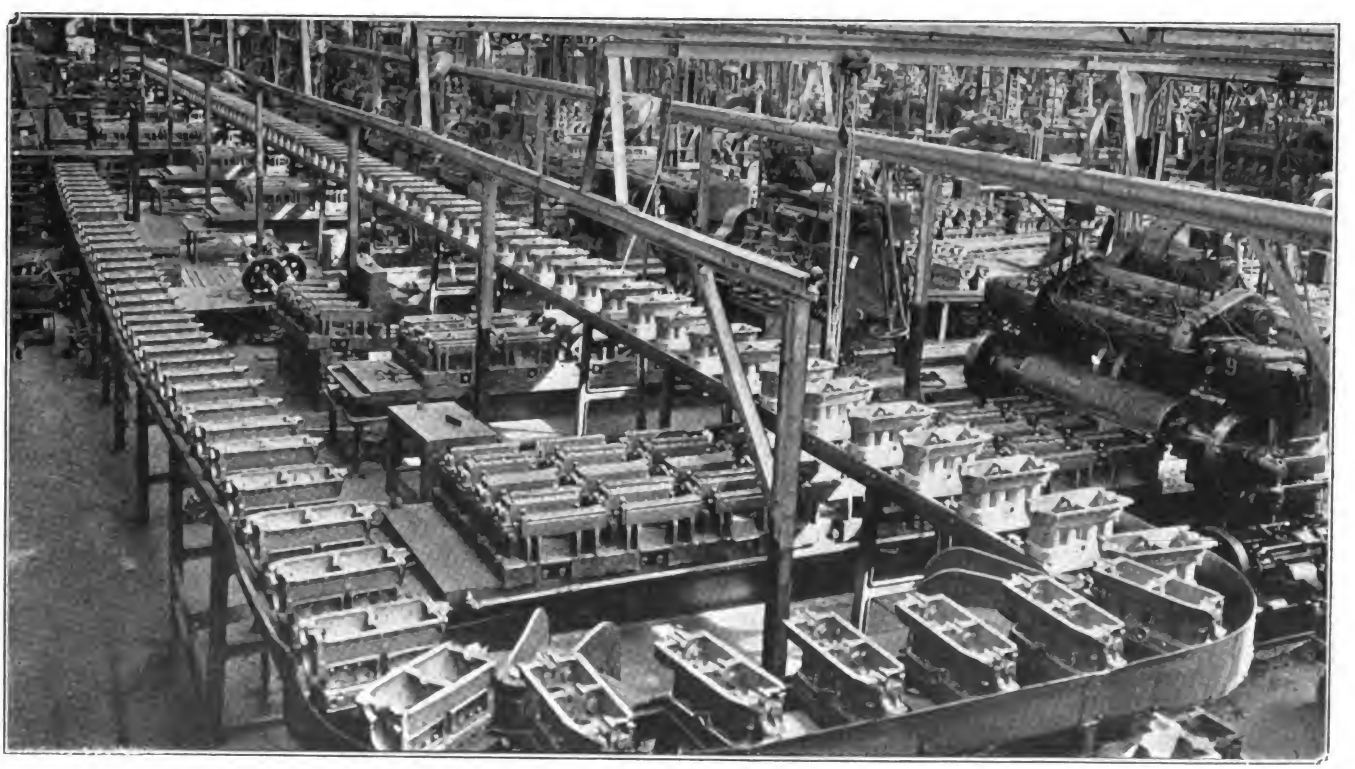

Fig. 1. Cylinder milling department, showing conveyor and constant supply of cylinders.

ever, to locate the cylinder block for the main operation of milling the base flange and the crankshaft-bearing seat.

Locating the Bottom Flange.

The top of the cylinder is placed under the yoke shown, with the locating points toward the milling cutters E and F, and the edge of the cylinder block resting on the hardened-steel strip G. The clamping plate H fits along the base flange, forcing the flange against two locating points, one being shown at I and the other hidden by clamping plate H. This locates the bottom flange so that the four locating spots are milled parallel with the flange. All four spots are milled at one setting.

Resting on the locating points just milled, and also centered by the outside of the end bearings in the V-blocks A, B and C, Fig. 4, the cylinders are bolted in large gangs to the table of the planer-type milling machines shown.

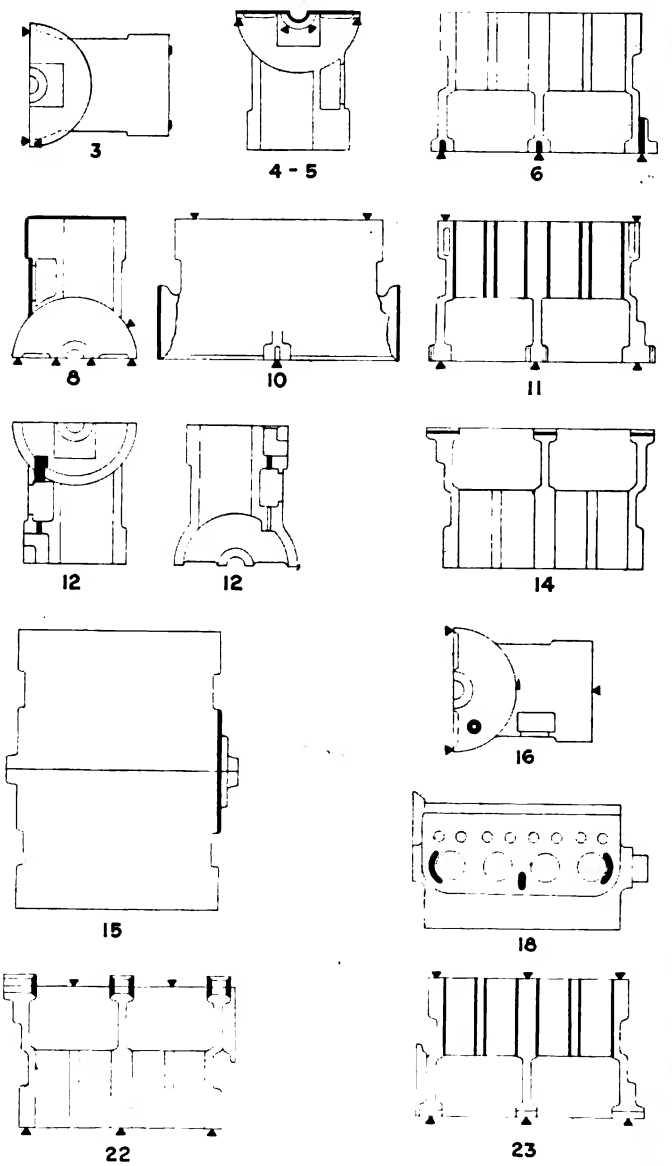

Fig. 2. Transformation sheet for Ford cylinder operations.

Details of the fixture and the work done are shown in Fig. 5.

The construction of the fixtures is shown in Fig. 5 as well as the self-clamping tongs for lowering the cylinder blocks into position, the locating points for supporting the flange, and the guard around the milling cutters. It should be noted that these machines carry both vertical

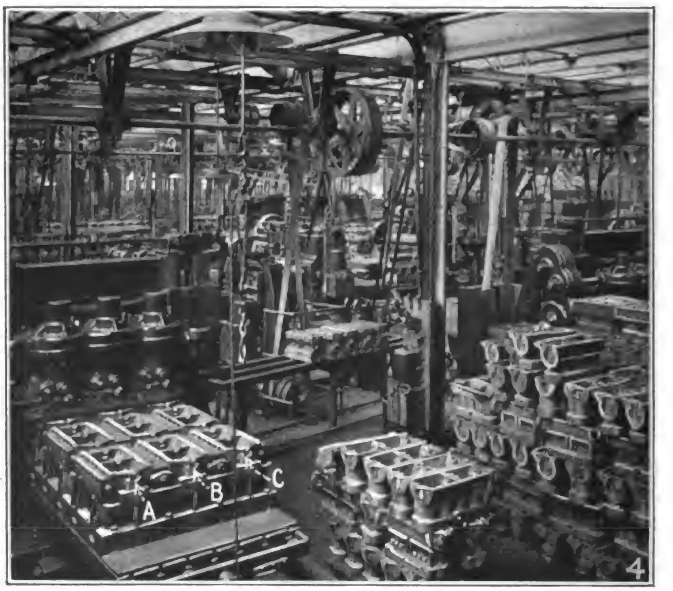

Fig. 4. Milling the base flange on planer-type machine.

and horizontal cutters. The former face off the flange, while the latter, as at A, mill the half-round seat for the babbitt for the three crankshaft bearings. These machines carry 32 cylinder blocks, there being eight rows of four each. Each machine handles about 35 blocks per hour.

Next comes the drilling of the six bolt holes by which the bearing caps are held in position. These also serve as locating holes for future operations. This is done on a special drilling machine of the inverted type shown in Fig. 6. The arms A and B are simply for convenience in resting the cylinder block while it is being pushed back into position, the slides C and D supporting the outer end. The block fits this opening and is easily clamped in position by the handwheel E. When the cylinder is fully clamped, the cam F is out of the way so that the rod G can spring back in position and start the feed. This, however, cannot be started until the block is properly clamped. The head carrying the block then feeds down over the drills, each machine handling about 22 cylinder blocks per hour.

Special Reaming Machine Handles 125 per Hour.

The two center holes are then reamed on the special machine shown in Fig. 7, these being used particularly as the future locating points. With the conveyor arrangement shown, and the ease with which these can be han-

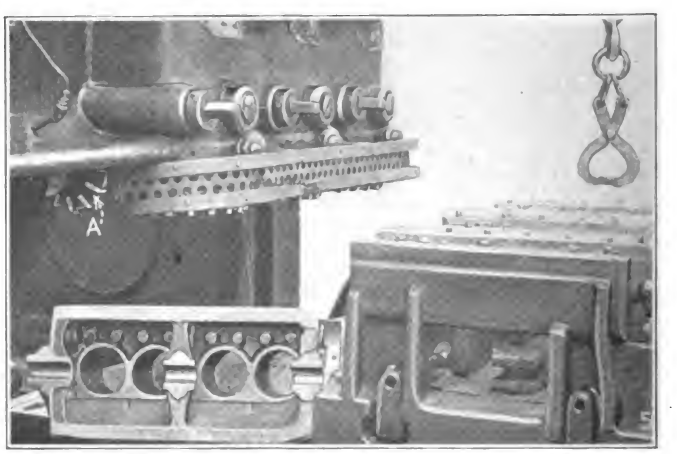

Fig. 5. Details of flange milling and fixture of Fig. 4.

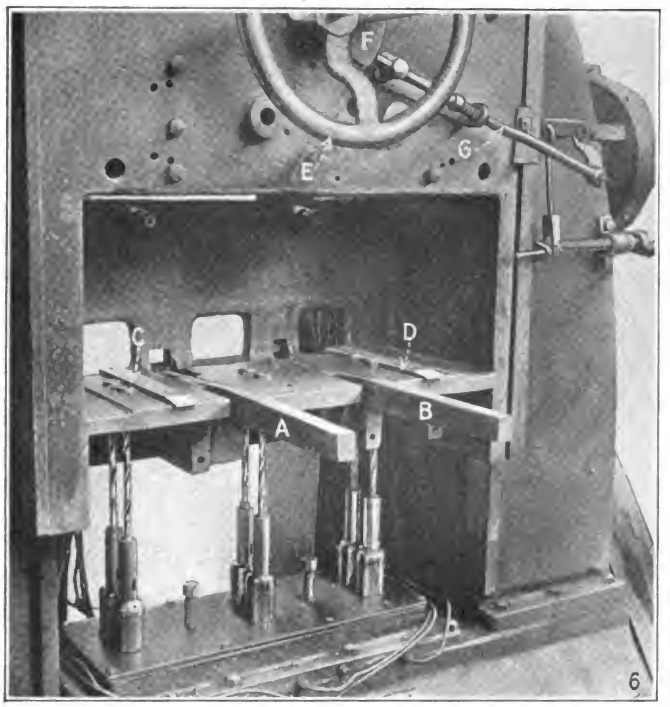

Fig. 6. Inverted drilling of the six bearing cap holes.

dled, this machine has a capacity of about 125 cylinder blocks per hour.

Then comes the milling of the top and sides, as shown in Fig. 8. This is not an unusual operation, and several types of machines are used on this work. The latest machine is a special one which carries 32 cylinder blocks at each setting, and handles about 43 cylinder blocks per hour.

The cylinders are then rough-bored on a special four-spindle machine, after which they are water-tested by the apparatus shown in Fig. 9. This is a double testing stand and enables two men to work in very close quarters. About 50 lb. water pressure is used, and as can be seen, rapid clamping methods are provided so that the work can be handled very quickly. Each operator has a pump which enables him to apply pressure easily and rapidly

Milling Both Ends of Block.

Both ends of the cylinder block are then milled on the double-head milling machine shown in Fig. 10. This is a simple operation, the blocks being grouped in close order on a long table which passes between the two milling heads.

The second boring comes next, after which the third or finish-boring is done on the machine shown in Fig. 11. This operation also includes chamfering the upper end of the bore by means of the angular cutters shown on the boring bar, after which the valve-stem and valve-seat holes are roughed out as shown in Fig. 12. The first boring is done at the left and the reaming at the right. The racks for suporting the cylinder blocks are clearly shown between the two rows of machines.

Careful attention is paid to the valve-stem holes and the push-rod holes, both being carefully reamed within close limits. The vaive-seat holes are cleaned out with an electric drill and are then rebored on special multiple-spindle drilling machines. Special drilling machines are

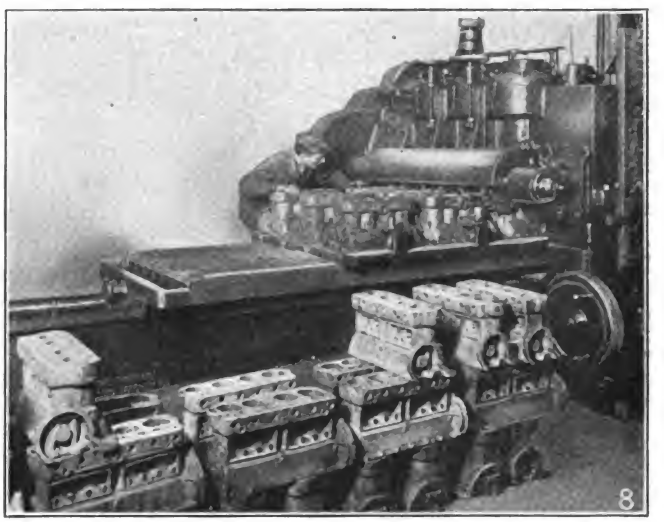

Fig. 8. Milling top and sides in large groups.

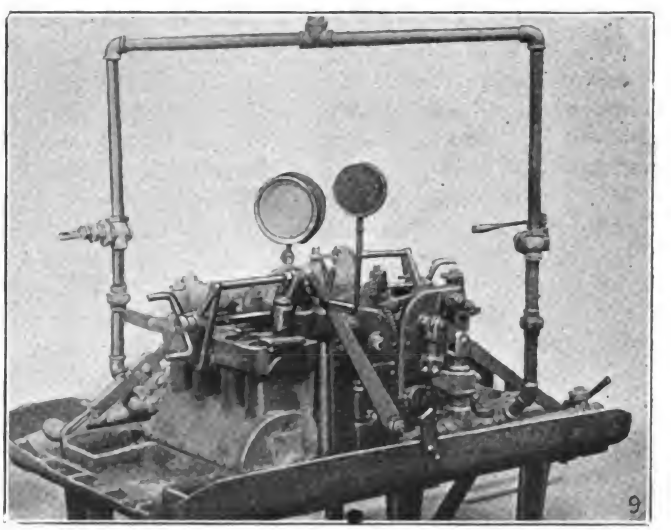

Fig. 9. Double fixture for water-testing after rough boring.

used wherever it is advantageous to do so, two of these being shown in Figs. 13 and 17.

The machine shown in Fig. 13 drills 15 holes in all from three directions. The cylinder block is located by means of the guide rail A which fits the seats for the babbitt bearings, and the block rests on the hardened rails B and C. A cam action locks the cylinder in place.

The main bearings are next bored in the fixture shown in Fig. 14. The cylinder block is located by dowels and clamped down on to the steel plates shown by means of the clamps A and B which are operated by the lever C and the arms D and E.

(To be continued)

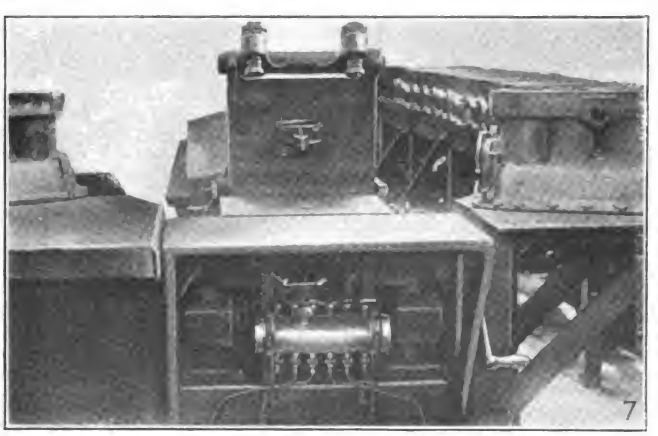

Fig. 7. Special machine for reaming two central holes.

Helpful Hints for Designers and Draftsmen

Information About Hindley, Worm Gear Inventor.

There have been a great many different statements made in the engineering press with regard to the inventor of the Hindley worm and gear. In a paper read before the Yorkshire Philosophical Society in England, by John Scott, some interesting information is given, based upon a thorough investigation into original sources. Henry Hindley was a noted clockmaker in York, England. He came to York about 1730, after having served his apprenticeship, it is believed, in Manchester. He died in 1771 at about seventy years of age.

One of his clocks is still in the Guildhall in York, and another in the Lord Mayor's House of the same city. Both clocks are keeping good time after 188 years of service. Another Hindley clock is installed at Clifton Castle. This clock goes for one year with one winding. It shows, besides the time of the day, also the date of the month, and is so arranged that it shows the correct date irrespective of the number of days in each month. It even has a correction for leap years.

Hindley's name has passed down in mechanical history not only as a clockmaker, but also as the inventor of the Hindley dividing engine, which was one of the first devices for accurately dividing a circle into any number of equal parts. In this device, he made use of the worm-gearing which has later been known by his name.

About 1785, John Smeaton, also a York man, wrote a paper to the Royal Society in which he stated that, in the autumn of 1741, he was first introduced to Henry Hindley, who had shown him his dividing engine, "at that time furnished with a dividing plate with a great variety of numbers for cutting the teeth of clock wheels, and also for more nice and curious purposes furnished with a wheel about 13 inches in diameter, very stout and strong, and cut into 360 teeth, to which was applied an endless screw adapted thereto; the threads of this screw were not formed upon a cylindric surface, but upon a solid, the sides of which were terminated by arcs of circles; the whole length contained fifteen threads, and as every thread on the side next the wheel pointed towards the center thereof, the whole fifteen were in contact together, and had been so ground with the wheel that to my great astonishment I found the screw would turn with the utmost freedom, interlocked with the teeth of the wheel, and would draw the wheel round without any shake or sticking, or the least sensation of inequality."

Diameter of Circle Found From Two Dimensions.

In connection with certain conditions, it was desired to find the diameter of the circle which would touch a point and two surfaces, these being located as Fig. 1 shows. The conditions were a vertical surface to which the circle had to be tangent, a horizontal surface at right angles to it, and marked BC in the figure, the length of this being 1 inch. At B the surface BA is erected parallel to the first surface, and through A a horizontal surface parallel to Bc. The height AB is ¼ inch, and the circle was required to be tangent to BC and pass through the point A.

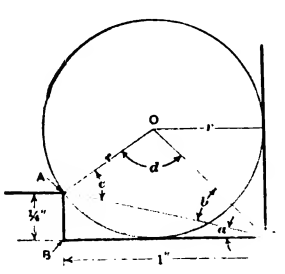

Fig. 1. Diagram showing point and two surfaces through which it is desired to pass a circle.

It is possible to solve this problem by using quadratic equations, but in this particular case, it was desirable to use plane trigonometry. Referring to Fig. 1, the problem was solved as follows:

$$\frac{AB}{BC} = 0.250 = \tan a$$

$$a = 14 \text{ degrees } 2 \text{ minutes } 10 \text{ seconds}$$

and

$$b = 45 \text{ degrees} - a = 30 \text{ degrees } 57 \text{ minutes } 50 \text{ seconds}$$

$$AC = \sqrt{(AB)^2+(BC)^2} = \sqrt{1.0625} = 1{,}0308 \text{ inches}$$

or

$$AC = \sec a \times 1 \text{ inch} = 1.0308 \text{ inches.}$$

From a corollary in mensuration, $OC = 1.41r$. According to the law of sines:

$$\frac{r}{1.414r} = \frac{\sin b}{\sin c}$$

from which

$$\sin c = 1.414 \times \sin b = 0.7275$$

and $c = 46$ degrees 40 minutes 39 seconds

Therefore

$d = 180$ deg. $- (b + c) = 102$ deg, 21 min. 31 sec.

Then

$$\frac{r}{AC} = \frac{\sin b}{\sin d}$$

from which

$$r = \frac{AC \sin b}{\sin d} = \frac{1.0308 \times 0.5145}{0.97683} = 0.5429 \text{ inch}$$

and the diameter of the circle, $2 \times 0.5429 = 1.0858$ inches.

New Solution Prevents Rusting of Metals.

All soldering solutions contain zinc chloride and zinc chloride always causes rust no matter how it is applied and no matter what the admixture is. In order to prevent trouble from soldering solutions, treat the metal with deoxidine after soldering and wipe off with water. Deoxidine dissolves rust, neutralizes soldering solutions, acids, hand marks, etc. It cleans the metal and prevents rerusting. It also slightly etches the metal which makes a painted finish hold firmly. Deoxidine is used extentively by the automobile trade for preparing the steel automobile bodies for painting where a high grade permanent finish is required.

Although deoxidine and the deoxidine process are patented, no royalties are charged, but the American Chemical Paint Company of Philadelphia, Pa., retains the sole right to manufacture and sell the chemical deoxidine.

New Type of Screw Head

A new form of screw has been developed which has a great advantage over existing types. This has the same appearance as the usual wood screw, but on the underside of the tapered head are formed a series of spiral edged grooves. These when the screw is driven down into the wood will cut off the edges of the straight hole, that is, a screw of this type would be its own countersink. In this way in those cases in which the screw head had to

be flush, considerable labor would be saved, for the additional operation of countersinking the hole for the body of the screw would be unnecessary; it would countersink its own screw hole as screwed down into it. The same principle could be applied to machine bolts to be used in the softer metals.

Importance to France of Lorraine Ore.

It is interesting to note what a tremendous advantage in an industrial way the possession of the Lorraine ore fields is going to be to France, and inversely what a big loss to Germany. The ironstone beds of German Lorraine cover 43,000 hectares (about 108,000 acres) and contain at a conservative estimate, 1,800 million tons of ore. In the three years before the war the output of iron ore in the German customs union was as follows:

	1911		1912		1913	
	Tons	%	Tons	%	Tons	%
Germany, without Lorraine	6,065,985	20.3	7,116,708	21.2	7,472,359	20.8
German-Lorraine	17,754,571	59.4	20,083,236	59.5	21,135,554	58.8
Luxemburg	6,050,797	0.3	6,533,930	1.9	7,333,372	20.4
Total	29,879,353	100.	33,733,874	100	35,941,285	100

For comparison the following table of the output of iron ore in France is given.

	1911		1912		1913	
	Tons	%	Tons	%	Tons	%
Briey	10,477,343	63.0	12,717,127	66.5	15,147,371	70.4
Nancy and Longwy	4,577,139	27.5	4,517,989	23.5	4,666,201	21.7
Rest of France	1,584,518	9.5	1,924,875	10.0	1,686.428	7.9
Total	16,639,000	100	19,160,000	100	21,500,000	100

Thus, the minette district of Briey, Nancy, and Longwy, the greater part of which was in German occupation, accounts for about 90 per cent of the total ironstone output of France. Its area is 61,000 hectares (153,000 acres) and it has an estimated ore deposit of 3,000 million tons. Hence the output of German-Lorraine alone was equal to the entire French output. Besides this, Germany formerly imported considerable quantities of iron ore, notably from Sweden and Spain, for her pig-iron production. France, on the other hand, was unable to use up the whole of her ore output and exported about 38 per cent, mostly to Belgium, which has hardly any mines, and to Germany. This is shown by the following table:

	Germany		France	
	1912	1913	1912	1913
Iron-ore consumption tons.	43,544,336	47,347,172	12,290,478	13,171,200
Home output, tons	33,733,874	35,944,285	19,160.000	21,500,000
Imports, tons	9,810,462	11,455,887	—	—
Exports, tons	—	—	+6,869,522	+8,328,800

Before the war the German iron output was to the French as 36 to 21, now it approximates 8 to 42, the balance—the Luxemburg production—going to Belgium, the latter small state thus obtaining a production approximately equal to that of Germany.

Suitability of Hickories for Vehicle Manufacture

The principal species of hickory are divided botanically into two groups, true hickories and pecan hickories. True hickories include shellbark, shagbark, mockernut, and pignut or black hickories. Pecans include bitternut, nutmeg, pecan, and water hickories.

The chief difference between true and pecan hickory, as shown by tests at the Forest Products Laboratory, is in toughness or shock-resisting ability. This is the property which is so valuable in wood handles and vehicle parts. In this property true hickories are far superior to the pecans.

The strength properties of pecan are somewhat in excess of those of oak or maple, and for such articles as handles and buggy spokes carefully selected pecan is probably to be preferred to either of these two woods. In heavy wagon parts, such as axles, spokes and felloes, maple and oak are reputed to stay in place better than hickory. Except in case of extreme shortage of maple, true hickory and oak, it would probably be inexpedient to use pecan hickory for these heavy parts.

The sapwood or white wood of hickory, which is usually preferred by the trade, is the better wood in young, thrifty trees; but in overmature trees it is inferior to the heartwood. A red color does not necessarily make sound hickory unsuitable for vehicle stock.

A more useful criterion than color is the proportion of summerwood, or nonporous wood, in the annual growth rings. In hickory stock intended for the more exacting uses, the nonporous wood should form at least one-half and preferably three-quarters of the annual ring; and the remaining part should contain very few pores. A further precaution to be observed is that the nonporous part of the annual ring should be hard and flinty.

The best criterion of the strength properties of either true or pecan hickory is the weight of a cubic foot of the dry wood. This weight should not be more than 10 per cent below the average for true hickory; or not less than 45 lbs. per cubic foot of oven-dry wood.

Road Transport via Motor Growing Rapidly in Britain

In England, as in this country, one of the lessons of the war, and the incidental breaking down of railroad transportation during it, has been to call marked attention to the utility of motor transport, and subsequently to bring about the establishment of many regular lines of motor transport, both public and private. Thus the London Times recently announced the establishment of a daily service between London and Birmingham. It has been organized as a result of investigation in Birmingham, which assured the promoters that a large amount of traffic from Birmingham to London was available. An extension of the service from Birmingham to Manchester is under consideration. The journey each way will be made by night in order to secure the delivery of goods during business hours on the following day.

The development of motor-lorry transport is being increasingly recognized by British business men. A motor-lorry which recently went from London to Cardiff brought back tobacco valued at $120,000. At Liverpool lorries provided by the Ministry of Transport to relieve dock congestion are operating over a radius of 25 miles. There is every indication that the scheme will be extended, and another 50 lorries be sent to Liverpool, as traders' applications for their use are being received in numbers. In Manchester 50 lorries are operating within a radius of 25 miles of the docks. There are 25,000 tons of goods waiting to be carried within that radius. In the Bristol district 100 lorries are working, and at the Avonmouth docks there are 30,000 tons of goods awaiting transport. At Hull where the radius to be covered is 40 miles, the lorries are dealing with large quantities of foodstuffs.

Mid-Continent Oil, Gas & Refining Co., large oil firm, has adopted the Cherry process for producing gasoline by electrochemical means and will build a 2,000 bbl. refinery at Vernon, Kas., for this purpose.

New and Improved Ideas in Body Finishing

Painters' Helps From the Orient

Many painters will be surprised to know what a number of materials useful in painting and varnishing work come to us from the Orient. For instance, during the last 10 years a product known as Chinese wood oil (tung oil) has been used extensively in the United States and has been found vastly superior to linseed oil in the manufacture of a certain type of high grade varnishes. Similarly, a product known as soya-bean oil, originally grown in Manchuria, has lately been adopted in the United States for application in the paint and varnish industries. The use of this oil, no doubt, will be of great interest to the manufacturers at this period when a shortage in flax has occurred.

The first serious shortage of linseed oil experienced in the United States was in 1910, when the flax crop failed in the northwest, to which section its growth is restricted. Previous to this period, and in fact as early as 1907, the rapidly increasing demand for linseed oil for various purposes led the paint manufacturers to give thought to methods for increasing the production not only of flax, but of other vegetable oils, such as soya. The latter was already being imported in small quantities and gave great promise as a paint oil. The flax shortage of 1910 stimulated this work, and a far-sighted campaign was at once inaugurated to study the question of domestic production.

Accordingly a large quantity of soya beans was imported from Manchuria, and these, together with some varieties grown experimentally in the United States were distributed at first to five states where they were planted through the co-operation of the State Agricultural Experiment Stations The active interest of the United States Department of Agriculture was enlisted in the problem. and with their aid during the year 1913, practically every agricultural experiment station in the country received and planted several varieties of the bean. As a result, information was obtained as to the varieties giving the most satisfactory yield and growth. In nearly every state successful harvests were obtained, thus demonstrating that the soya is a plant that could be grown not only in a restricted area but in nearly every region of the country.

The southern portion of the country apparently afforded most excellent climatic conditions for growing the soya bean. Fortunately there are located in the southern states a number of cottonseed crushing plants, and through their co-operation the representative of the paint manufacturers' organization was able to have crushed considerable quantities of oil from beans grown in several districts. The cottonseed crushers' interest in this work was thus obtained, as the presence of an oil-seed crop other than cottonseed would make more continuous the operation of the crushing plants and the employment of labor. One ton of soya beans yields by expression about 38 gallons of oil, the residue, a cake, being disposable for cattle feed at an attractive price.

Coincident with the above field investigation, extensive laboratory tests were conducted on oils expressed from a large number of varieties of the bean. A study of the physical and chemical constants of the oils was made and their practical adaptation for use in paints and varnishes was demonstrated. Methods of heat treatment to improve the body of the raw oil were developed, and a careful research into the efficiency of many metallic drying salts was conducted. With the data obtained from this work paint manufacturers were enabled to apply the scientific principles necessary to use soya oil in place of linseed oil in teh manufacture of paints. Large working batches of paints were prepared, containing soya oil alone and in various percentages with linseed oil. Some of these paints were applied to test panels and others were used under practical conditions on full sized structures. Exposure of these paints over a number of years in different localities, including repainting tests, demonstrated that soya oil is a highly desirable paint oil when intelligently handled by the paint manufacturers.

Skill in Mixing Colors.

Very few painters appreciate or give sufficient weight to the importance of mixing colors. Taking the finished mixture, it will be found that by far the largest part of it is the vehicle, the color being of relatively small amount. This means, if it means anything, that the thinning medium must be added according to certain and careful measurements of quantity. The thinning medium is more responsible for anything which goes wrong in the color than the color, one time with another. A guess at the quantity of thinning medium to be employed for thinning any given quantity of pigment is more than likely to lead to all sorts of trouble, in all cases, and as a matter of daily practice which experience has demonstrated to be correct, the quantity of thinning mediums should be accurately measured. There should be some fixed standard of measurement to govern the proportion of oil or other binding medium as well as the turpentine. With these proportions fixed upon, and adhered to, the trouble of color going wrong or refusing to hold fast to the surface, will be reduced to a very small affair.

Different makes of colors require in mixing different proportions of turpentine, one color, for example, by reason of greater body and strength, requiring a greater amount of thinner to make it ready for use than another color weaker in body and substance and covering power. The user of the color should not be slow in determining these qualities. An excess of turpentine in a color may so act upon the pigment that it apparently does not dry, although in effect it may be as dry as it possibly can be. If the proportion of turpentine is unduly increased the proportion of binder in the mixed color is correspondingly decreased. Under such conditions the color, when dry, will rub up and crack off on the hands. If the color is then varnished over, it is practically certain to look uneven and rough.

In preparing color for use take the quantity needed to complete the work in hand and place it in the cup and with the mixing paddle break it down to a paste-like consistency and then add turpentine gradually, meanwhile beating up the mass and mixing thoroughly. All colors in preparing for use should be thoroughly beaten and worked out to a thin, smooth, free-working material. It is well to remember in connection with the thinning of black pigments that the highest grade blacks, such as

ivory black and jet black, are less opaque and contain a smaller quantity of real covering matter than some of the cheaper blacks. Generally speaking the more transparent blacks, those with the poorer covering properties possess the most brilliant and finest tones. It often occurs that a really high-class black is condemned because of this very thing. All black or dark pigments, as a matter of fact, have their color beauty greatly enhanced by using them for final coatings in the form of varnish-color. With varnish the real quality and fineness of the color is brought out. Probably the finest color effects are produced from the employment of lake pigments such as English crimson lake, English scarlet lake, Carmine lake, English purple lake, Chatimuc lake, and Munich lake. The ground for these colors should correspond as nearly as possible to the color of the lake. As a rule, all lakes, and particularly all of the lakes above mentioned, are rich in proportion to their depth. A crimson lake, for example, needs a warm, red ground. A scarlet glazed over a ground made of Tuscan red and deep orange chrome yellow will do as well as under any other treatment, although for the most brilliant effects the lake had best be applied over an English vermilion ground, the vermilion being in turn applied over a ground made of Indian red and white, the red being added to the white in a proportion to provide a deep peach blow color. Munich lake, one of the oldest but one of the finest of lake pigments, is produced with the best color effects by laying the lake directly over a medium wine color, the wine color being laid over a ground of Indian red. Perhaps in these later years among the very elect in carriage and automobile circles, no member of the lake family has met with such favor as English purple lake. This is a magnificent panel color carrying with it a tone of splendid brilliancy, and on the very best class of horseless and horse-drawn vehicles, it contributes an effect notable from every view point. This lake can be effectively glazed over a ground of ivory or jet black. Perhaps two coats of the lake will be necessary in order to secure an absolute dense, solid color.

Probably one of the latest color fads for small panels on big touring cars, limousines, etc., is produced by using green lake glazed over a pure white ground. Chatimuc lake is produced in its best effect by glazing over a deep carmine ground, this ground being made of Indian red and ivory black, the black being added to the red to deepen the color. In developing lake effects a great deal depends upon the ground color. All lakes, in common with all transparent pigments, are to a very great extent controlled by the ground color. For this reason these colors should be brought up with the greatest possible care. Indeed, so far as anything can be perfect, these ground coats should be perfect; so much so, in fact, that when brought up to the final coat no touching up or surface repairs may be needed. When expert attention is given the ground coats the application of the lakes or other transparent pigments becomes a comparatively easy matter.

How to Paint Radiators.

Car owners experience a whole lot of trouble with the painting of radiators because the painter who did the work did not understand how to do it. The painter is inclined to forget that the air passages through the radiator are of extreme importance and must not be clogged up because they really form the breathing apparatus. Unless the paint applied to the radiator is applied in thin body, successive coatings will clog these air passages. It not infrequently happens that the painter is the object of much faultfinding on the part of the car owner from this very trouble, and it is sometimes the case that he has to clean this surplus paint off at no small expense. The radiator needs simply a very thin coat of some good wearing pigment.

For many of the dark colors such as black, dark blue, deep green, or maroon, liquid asphaltum, a product of bitumen, serves the purpose in good shape. Cut the asphaltum down to a rather thin consistency with pure turpentine and apply it in a temperature of from seventy to seventy-five degrees so that during application it may maintain the same thin body. For a pale yellow, buff, or light brown car, ordinary gold bronze will make a good material for this work. Mix the bronze in two-thirds coach Japan, or pale drying-Japan, and one-third finishing-varnish. If this bronze is suspected of being a little short of the best quality it had best be thinned out after mixing with the above ingredients with benzine or an eighty-eight degree gasoline. The verdigris contents of the mixture will come to the top, and with the evaporation of the benzine or gasoline, will remain there. In eight or ten hours this verdigris will be largely extracted. Upon removal the bronze may then be again mixed with a result that you will have an article far superior to the original mixture, both in brilliancy and in durability. The best results obtained with the use of bronze upon these parts are, however, secured by using the bronze in a dry form. Simply mix the Japan and finishing-varnish in the proportions above stated and apply with a camel's hair brush. When this coat has dried down to the proper tack, which will be a tack just sufficient to catch and hold fast the dry powder, proceed to apply the dry bronze, using for this purpose a camel's hair brush which has not hitherto been used in any wet pigment. The bronze, so applied, will have a high, bright lustre, and if of good quality, will wear better than when applied as ordinary paint.

Aluminum bronze is largely used for radiators and in combination with any of the lighter colors, it gives a good account of itself. Used upon a car painted black, or deep green, or dark blue, the aluminum presents a white appearance, and, in fact, upon superficial examination might be mistaken for white paint. When either of the bronzes are applied in paint form, the best thinner, all things considered, is what is commonly known as lacquer thinner or banana liquid.

Number of Motor Vehicles in Samoa

Seven years ago there were no motor vehicles in western Samoa. Today there are 19 motor trucks, 49 passenger cars, and six motorcycles. Two of the trucks, two of the cars, and four of the cycles are of British manufacture; all the others are American. Trucks are used principally in hauling goods from steamers and in bringing in copra from the plantations. No motor vehicles are owned by the natives, who number about 30,000. There are not more than 600 whites and half-castes in western Samoa, and therefore the possibilities of this market are very limited.

The state of Pennsylvania has 2,419 farm tractors in operation, according to its Agricultural Department.

Petroleum in Ontario

The past two years have witnessed slight increases in petroleum production, due to the development of the new Mosa field in the county of Middlesex, in Ontario, so that the production in 1918 was not only 90,909 barrels, of 42 per cent in excess of that of 1917, but was the largest production that has been reached since 1910. A bounty of 1½ cents per gallon is paid on the marketed production of crude oil from Canadian oil fields, the administration of the "Petroleum Bounty Act" being under the Department of Trade and Commerce. According to the bounty record the production in 1918 in Ontario was 288,692 barrels (10,104,220 imperial gallons) which at the average price per barrel of $2.694 was worth $777,737. The New Brunswick production according to bounty payments was 3,009 barrels worth about $7,402 or an average value of $2.46. For five years there has been a small but growing production of crude petroleum in Alberta, the greater part of which, however, does not earn the bounty because of its lightness, or low specific gravity. The approximate production in 1918 was 13,040 barrels valued at $100,004.

The total production in Canada from all sources was therefore 304,741 barrels (10,665,935 imperial gallons) valued at $885,143.

The price of crude oil at Petrolia was quoted at $2.48 for August 20, 1917, to February 12, 1918, when the price was increased 10 cents to $2.58. On March 21, the price was again increased by 10 cents to $2.68, and on July 10, to $2.78, remaining at this price to the end of the year. The average monthly price for the year was thus $2.69 1-3, as against an average of $2.33¼ in 1917; $1.98 in 1916, and $1.39½ in 1915.

The production in barrels of the various fields in the Province of Ontario as kindly furnished by the Supervisor of Petroleum Bounties at Petrolia was as follows: Petrolia and Enniskillen, 65,467; Oil Springs, 44,671; Moore township, 6,367; Sarnia township, 3,438; Plympton township, 412; Bothwell, 29,116; Tilbury, 25,228; Dutton, 1,875; Onondaga, 1,186; Belle River, 447; Mosa township, 108,988; Thamesville, 1,566.

The production in New Brunswick is all obtained in the Stoney Creek district, Albert Co. The Alberta production was obtained from five wells situated in the Turner Valley field, near Black Diamond, about 35 miles southwest of Calgary.

In 1918 ten oil refineries in Canada used 262,641,155 gallons of crude oil of which 250,382,965 gallons were imported, and 12,258,190 gallons were obtained from Canadian wells. The production of refined oils and petroleum products included gasoline and motor oils, 72,175,768 gallons; benzoline, benzene, and other light oils, 1,530,592 gallons; illuminating oils 65,268,598 gallons; lubricating oils, 14,402,523 gallons; gas and fuel oils and tar, 79,092,347 gallons; wax and candles, 13,759,972 pounds. There was also a production of asphalt and other products. The total value of the products of refineries was $37,287,891.

According to inspection returns of the Inland Revenue Department the total quantity of illuminating oils inspected during the calendar year 1918 was 55,443,056 gallons and the quantity of naphtha or gasoline and other light oils was 74,310,352 gallons.

Exports of petroleum entered as crude mineral oil in 1918 were 270,302 gallons valued at $28,415, and of refined oil, 1,946,967 gallons, valued at $206,675. There was also an export of naphtha or gasoline of 91,229 gallons, valued at $28,778.

The total value of the imports of petroleum and petroleum products in 1918 was $30,749,580, as against a value of $22,957,688 in 1917.

The total quantity of petroleum oils, crude and refined, imported in 1918, was 420,728,933 gallons, as compared with 379,148,006 gallons in 1917.

Production of Canadian Graphite

Notwithstanding the importance of this product as a "war mineral" and the strong demand therefor, the production of graphite in 1918 was considerably less than in 1917. The total shipments were 3,114 tons, valued at $248,870, as against 3,714 tons, valued at $402,892 in the previous year.

By provinces the 1918 shipments included 2,934 tons, valued at $208,852, from Ontario, and 180 tons, valued at $40,018, from Quebec, including a small shipment from Baffin Land.

In 1917 Ontario contributed 3,173 tons, valued at $296,587, and Quebec and Baffin Land, 541 tons, valued at $106,305.

The quantity of ore milled during the year was 11,358 tons, from which was produced 3,225 tons of milled, or refined graphite.

The total quantity of ore milled during the year 1917 was 19,614 tons, from which were produced 4,003 tons of refined, or milled graphite. From three mills operating on disseminated flake ores, the average recovery of refined graphite was 5.5 per cent in 1918 and 8.6 per cent in 1917 of the rock milled. The Black Donald—Calabogie, Ont.—ore consists largely of amorphous graphite, from which a large mill recovery is made.

Graphite operators reported that of the total shipments, 2,856 tons, valued at $214,345, were sold for export. Trade records show exports of plumbago, crude ore and concentrate, 664 tons, valued at $32,710, and manufactures of plumbago, probably refined, valued at $205,993, a total export of $238,703.

By grades the shipments included 366 tons of No. 1 flake, valued at $97,518, or an average of $266.44 per ton; 73 tons of No. 2 flake, valued at $13,780, or an average of $188.77 per ton; and 2,675 tons of No. 3 and dust, valued at $137,572, or an average of $51.43 per ton.

Utility of Calcium Limes in Glues

In making water-resistant glue, lime is probably the most essential constituent used with casein. Commercial lime varies widely in purity, but the degree of purity, according to tests made at the U. S. Forest Products Laboratory, is not a determining factor in glue making. It is only necessary that a sufficient quantity of lime material be used to insure the actual calcium hydroxide content called for in the formula. If this precaution is neglected the result from the standpoint of water-resistant qualities will be unsatisfactory.

When a lime of unknown analysis is to be used in a formula which has given success with other limes, it is desirable to begin with an amount which will give a glue of short or medium working life and a satisfactory flow. In the formula studied at the laboratory, low-grade limes gave a slow rate of solution of the casein, high viscosity, and abnormally long life. In any event, tests of the water resistance of the glue in which the new lime is used should be made as soon as possible.

Current Automotive Metal and Supply Prices

Iron and Steel Although the production is mounting rapidly, and many of the prices are going up with it, there is little sign of slackening interest. Pig iron production in March was at the rate of 108,900 tons a day or 40,000,000 for the year, compared with 102,720 in February. Steel ingot production is up to the highest level since December, 1918, and points to an output of 43-44,000,000 tons per year. Mills are selling more freely.

Copper and Aluminum March buying proves to have been the heaviest for many months, but subsequently, demand has fallen off. After slight weakening around the first of the month, the price has stiffened and rules at 19½c. N. Y. for April-May lake. General figures on the world situation seem to indicate higher prices. Aluminum stands at 33c. for the pure metal.

Lead and Tin Strikes in New York and a consequent shortage of supplies have kept lead firm in price, even in a very quiet market. Quotations are 9¼c. by the leading interests and 9c. outside, both N. Y. Production is still less than consumption. Tin prices are largely nominal, due to the recent holidays in London. There is much latent demand, however, which is expected to keep prices firm. Spot is now held at 63¼c. N. Y.

Zinc and Other Metals Market is exceedingly quiet, prime Western being held at 8.6c. for early and second quarter. Leading producers are confident of higher prices, one having predicted 10c. by midsummer. Antimony is quiet and unchanged around 11½c. Foreign supplies of ferromanganese being very light, domestic prices have stiffened, and now are at $200 or higher. Other ferro alloys show little change.

Old Metals Steel and iron scrap are slightly lower in spots, while non-ferrous scrap shows little change. Light and heavy brass are each up ¼c. Aluminum is in heavy demand.

Chemicals Supplies are not being replenished by producers as rapidly as they are being bought up, so tendency of all prices is upward. Based on large foreign sales, a number of products moved up. Coal tar products are firm in price, supplies being tight. Turpentine is up, close to $2.50, and little is available.

Fabrics Cotton yarns and cloth are both higher. Burlap has stiffened and is now sold on basis of 9.75c. for April-June lightweights.

Other Materials Rubber is steady, and better grades are slightly higher than last month. Recently there have been more buyers than sellers, which would indicate further advances. Hides are firm, Bogotas being quoted at 40 with sellers holding out for higher figures. After advances of last month, none of the petroleum products have changed, but Government statistics indicate such a shortage of production that with months of heavier consumption approaching prices must move to much higher levels.

Every effort is made to have the following prevailing prices (compared with last month's) accurate but none is guaranteed. They are obtained through trade sources and may not be realized on small quantities:

	Mar. 9	Apr. 6
Acid, Sulphuric, 66°.....ton	$22.00 —25.00	$22.00 —25.00
Alcohol, Ethyl, 97 p.c.....gal.	6.00 — 7.00	6.00 — 7.00
Alcohol, denatured, 190 proof, gal.	.67 — .74	.98 — 1.02
Aluminum, Ingots No. 1 99% pure, carload lots.....lb.	.35 — .38	.33
Ammonium Chloride (Sal-Ammoniac) white, granular....lb.	.17 — .19	.16 — .18
Babbitt Metal, best grade.....lb.	.90	.90
Babbitt Metal, Commercial....lb.	.50	.50
Beeswax, natural crude, yellow.lb.	.42 — .45	..
Carnauba No. 1 Wax.....lb.	.80 — .88	.80 — .88
Caustic Potash (85-92 p. c.)..lb.	.35 — .42	.30 — .35
Caustic Soda, 76 p. c.....100 lb.	4.85 — 5.25	6.10 — 6.25
Pumice, Ground (domestic)....lb.	.02½	.02½
Shellac, Orange, superfine....lb.	1.65 — 1.70	1.50 — 1.55
Tin, Metallic straits pig.....lb.	.60¼	.65
Turpentine, spirits of crude.....	1.99	2.35
Zinc, Western Spelter.....lb.	.086	.10¼— .11¼
No. 9 base casks, open.....lb.	.14	.14½

IRON AND STEEL, PIG, BARS, ALLOYS, OLD METAL

Pig, per ton—	Mar. 9	Apr. 6
No. 2 X, Philadelphia§.....	$45.35	$47.05
No. 2, Valley furnace†.....	41.00	43.00
Basic, delivered, eastern Pa.....	43.40	44.80
Basic, Valley furnace.....	41.00	42.00
Bessemer, Pittsburgh	43.40	43.40
Malleable, Valley	42.00	43.00
Bars—		
Merchant iron, base price.....	....	....
Refined iron base price.....	4.50c	4.75c
Soft Steel—		
¾ to 1⅞ in., round and square..	3.52—4.25c	3.52—4.75c
1 to 6 in. x ⅜ to 1 in.....	3.52—4.25c	3.52—4.75c
1 to 6 in. x ¼ and 5/16.....	3.62—4.35c	3.62—4.85c
Rods—⅝ and 11/16.....	3.57—4.05c	3.57—4.55c
Bands—1½ to 6 x 3/16 to No. 8..	4.22—5.25c	4.22—5.75c
Ferromanganese, 76% to 80% delivered producers' price.....	$175.00	$200.00—225.00
Spiegel, 18% to 22% furnace, spot	57.00 to 60.00	55.00— 70.00
Ferrosilicon, 50%, spot, delivered	85.00 to 95.00	85.00— 90.00
Ferrotungsten, standard, per lb. contained, furnace	.90 to 1.10	.90— 1.10
Old Metal		
Heavy steel scrap, Pittsburgh...	$27.00	27.00
Heavy steel scrap, Philadelphia..	25.50	24.50
No. 1 cast, Pittsburgh.....	34.00	34.00
No. 1 cast, Philadelphia.....	40.00	38.00

†Silicon, 1.75 to 2.25. §Silicon, 2.25 to 2.75.
Ferrosilicon prices at Ashland, Ky., Jackson and N. Straitsville, O.

BOLTS AND NUTS

	Mar. 9 % off list	Apr. 6 % off list
Machine bolts, c.p.c. and t. nuts, ⅜ x 4 in.:		
Smaller and shorter.....	35	35
Carriage bolts, ⅜ x 6 in.:		
Smaller and shorter, rolled threads	40-5	40— 5
Cut threads	30-10	30—10
Semi-finished hex. nuts:		
⅜ in. and larger.....	60-5	60— 5
9/16 in. and smaller.....	70-5	70— 5
Tire bolts	55-10	55—10

The above discounts are from November 1, 1919.

BRASS, COPPER SHEETS, SHAPES, VIRGIN METAL, SCRAP

	Mar. 9	Apr. 6
Copper, Lake, ingot.....lb.	$0.18½	$0.19½
Copper, Electrolytic .....lb.	.18⅝	.19¼
Copper, Casting .....lb.		.19
Copper sheets, hot rolled.....lb.	.29½	.29½
Copper sheets, cold rolled.....lb.	.31½	.31½
High brass wire and sheets....lb.	.26½	.25¼
High brass rods.....lb.	.23¾	.23¾
Low brass wire and sheets....lb.	.28½	.27¼
Low brass rods.....lb.	.29½	.28
Seamless bronze tubing.....lb.	.33½	.32
Seamless brass tubing.....lb.	.32	.33
Old Metal—		
Copper light and bottoms.....	14.50c	.14½
Brass, heavy	10.50c	.10¾
Brass, light	7.75c	.08
Heavy machine composition.....	15.75c	.16
No. 1 yellow brass turnings.....	9.75c	.09¾
No. 1 red brass or comp. turnings	12.75c	.12¾

CRUDE RUBBER

	Mar. 8	Apr. 7
Para, Upriver fine.....lb.	$0.42½—$0.44	$0.42
Upriver coarse .....lb.	.31½— .35	.32
Upriver caucho ball.....lb.	31½— .34½	.32
Plantation, first latex crepe...lb.	.46¼— .49	.46
Ribbed smoked sheets.....lb.	.46 — .48	.45½
Brown crepe, thin, clean....lb.	.41 — .43	.45

PETROLEUM PRODUCTS

	Mar. 16	Apr. 7
Oil—Pennsylvania Crude	$6.10	..$6.10
Kansas and Oklahoma Crude..	3.50	3.50
Gasoline,Motor,garages,steel bbls..	.28½	.28½
Consumers, steel bbls.....	.30½	.30½
Lubricating Oil, black, 29 gravity	.25—.35	.25—.35
Cyl. light filtered.....	.70—.75	.72—.80
Dark filtered	.70—.75	.70—.75

Men of the Automotive Industry

Who They Are What They Are What They Are Doing

C. J. Strouble has been placed in charge of the new top material manufacturing plant of the Athol Mfg. Co., Athol, Mass., located at Marysville, Mich. Strouble, who is superintendent of the plant now in course of erection, comes to the Athol company from the Boston Woven Hose Co., and from his reports of progress it is indicated that the Marysville plant will be ready for operations by July 1. Though definite details are withheld, it is assumed in quarters close to the company that much of the 29,000 square feet of floor space will be devoted to supplying the requirements of the big Wills-Lee enterprise, which is the predominating factor in the Marysville development

Charles M. Manly and C. B. Veal, well-known in automotive engineering circles, have opened offices as industrial engineers at 250 West Fifty-fourth Street, New York. Manly, who was president of the Society of Automotive Engineers last year, has long been associated with the automobile industry. During the war he was a vice-president of the Curtiss Aeroplane & Motor Corp., acting as consulting engineer in charge of all inspection. Veal, in charge of the department of machine design at Purdue University, likewise, has been active in S. A. E. affairs, and was also associated in the Curtiss inspection work during the war.

L. Clayon Hill has opened offices in the Holden building, Detroit, where he will maintain an organization to engage in the general practise of consulting engineering, specializing in automotive subjects. Hill was associated with the Packard Motor Car Co. for eight years, first in the chassis design work, and later held the position of body engineer and aeroplane engineer. After leaving the Packard company, Hill became connected with Captain Lepere in the Franco-American Engineering Co. During the war he was associated with the French Aviation Mission under Capt. Lapere, designer of the Lapere plane.

William Kelly, chief engineer of the Maxwell Motor Co., has severed his relations with that company after his long connection with it. Kelly has long been associated with the industry and with the various enterprises from which the present Maxwell-Chalmers organization sprang. He was designer for the old Wayne Motor, later was with the E-M-F., and finally with the Metzger Motor Car Co., which was the active unit on which the present Maxwell company was built after Walter E. Flanders took over the wreck of the former United States Motor Co.

E. B. Mull, at one time assistant director of service of the Willys-Overland Co., Toledo, has joined the Overland-Harper Co., Philadelphia, Pa., as plant superintendent. Mull assisted Claude Cox in designing and building the first Overland car back in 1902. Since that time he has been continually engaged in manufacturing or service work. Besides being connected with the Overland organization, Mull served as superintendent of the old Interstate Automobile Co., and as general superintendent of the Brown Commercial Car Co.

M. Charles Schweinert, who entered the employ of A. Schrader's Son, Inc., 34 years ago in the capacity of office boy, and who has been associated with that company ever since, has been elected president, succeeding the late Dr. Charles K. Cole. Among other things, Schweinert is credited with having developed the export department of A. Schrader's Son and establishing the Schrader sales policy, which is based upon a license agreement.

R. W. Judson, formerly vice-president of the Continental Motors Corp., Detroit, now signs his name as president of that organization. The first intimation of a change in the personnel of the organization was revealed in a letter to stockholders explaining the new $5,000,000 note issue which was signed by Judson as president. Benjamin F. Tobin, former president, now appears as chairman of the board of directors.

Ralph S. Allen, general sales manager of the Duratex Co., Newark, N. J., has been appointed a vice-president of that organization and a member of the board of directors. Prior to his association with the Duratex organization Allen was for a number of years sales manager of the Wagner Electric Co., Detroit, and prior to that was identified with several well known accessory manufacturers.

Frank H. Golding, for the past four years vice-president and general manager of the Ohio-Power Co., has been elected general manager of the Holmes Automobile Co., Canton, Ohio. The stockholders re-elected the old board of directors and the following officers were elected: Arthur Holmes, president and treasurer; G. H. Rockwell, vice-president, and George W. Belden, secretary.

Kelly R. Jacoby, who resigned as vice-president in charge of purchases for the Willys-Overland Co., is planning to enter actively into the manufacture of electrical products. He has selected Dayton, Ohio, as his future headquarters, where, through a company that he has reorganized, he will manufacture electric motors and generators.

F. R. Humpage, vice-president and general manager of the Wilt Twist Drill Co. of Canada, Ltd., Walkerville, has resigned. Humpage has been in ill health for some time and left for Miami, Fla. When his health is restored, he anticipates placing a cleaning compound, in which he has become interested, on the market.

James McGlashan, for two years head of the engineering department at the York, Pa., plant of the Martin-Parry Corporation, has been advanced to the position of chief engineer. In his new capacity, McGlashan assumes charge of the engineering departments at the Martin-Parry plants at York and Indianapolis.

R. O. Hendrickson, who was formerly chief engineer of the Wallis Tractor Co., Racine, Wis., has been appointed vice-president in charge of the engineering of the J. I. Case Plow Works Co., also of that city, following the absorption of the Wallis company by the J. I. Case Plow Works.

Henry G. McComb, one of the pioneer engineers of the automobile industry, has been appointed general manager of the Russel Motor Axle Co., Detroit. McComb was chosen for this position by the McCord Mfg. Co., Inc., which now owns and operates the Russel company.

Frederick A. Merliss has been elected vice-president and manager of sales of the United Smelting & Aluminum Co., Inc., New Haven, Conn. He has been with the company for three years as assistant secretary, and he succeeds L. M. Brile, former vice-president and sales manager.

E. W. Bernhard, formerly of Providence, R. I., and for a number of years with the Hess-Bright Mfg. Co., Philadelphia, as planning manager, has been made assistant to the general factory manager; H. W. Jackson, also of the same concern, has been promoted to factory manager.

Walter C. Robbins has resigned as chief engineer of the Curtiss Aeroplane & Motor Corporation, Buffalo, N. Y., and is now practising consulting engineering in that city. He is specializing in internal-combustion engines, manufacturing, aeronautics and automobiles.

George B. Russel retired from the Russel Motor Axle Co. on February 1. Russel was the founder of the business, which has now passed into the hands of the McCord interests, and was one of the pioneers in the development of the internal gear drive axle.

C. L. Sonen, production engineer of the Teetor-Hartley Motor Corp., Hagerstown, Ind., and of the Ansted Engineering Co., Connersville, Ind., has resigned and formed the C. L. Sonen Co., Indianapolis, industrial engineer and metal processing plants.

E. L. Carter, formerly with the Bucyrus Co., Milwaukee, and the Remington Arms Co., at Eddystone, has become general manager of McCord & Co., West Pullman, Ill., manufacturers of gray iron cylinder casting and steel casting for the automobile trade.

Ernest T. Pearsons, recently with the Locomobile Co., Bridgeport, Conn., and formerly with the Winton Motor Car Co., Cleveland, and the Packard Motor Car Co., Detroit, has been made body engineer for the Stevens-Duryea, Inc., Chicopee, Mass.

H. P. Meredith, formerly maintenance engineer for E. L. duPont de Nemours & Co., and previously assistant to Vice-President Atterbury of the Pennsylvania Railroad, has been appointed manufacturing manager of the Saxon Motor Car Co., Detroit.

Robert Potter Breese, who during the war was officer in charge of the engineering department of the air service at Hazelhurst Field, Mineola, has joined the engineering staff of the Loening Aeronautical Engineering Corp. of New York.

J. Zagora has resigned as designing and production engineer of the Anderson Motor Co., Rock Hill, S. C., and has established a plant for the manufacture of automotive parts and smaller assemblies, under the name of J. Zagora Mfg. Co.

A. R. Waterman is now eastern district manager for the Splitdorf Electrical Co., with headquarters at 7 West 61st street, New York City. For a long time previous to this move, Waterman was connected with the E. V. Hartford Co.

John E. Hubbell, formerly of Chambers & Hubbell, patent attorneys, Philadelphia, Pa., has opened offices at 469 Fifth avenue, New York, where his practice will be devoted exclusively to patent and trade mark matters.

Frederick A. Parkhurst announces the opening of an office at the Grand Central Terminal Building, New York City. He will specialize as an organizing engineer on organization, management and production problems.

A. G. Ripberger, formerly of the engineering staff of the Illinois Steel Co., at Gary, Ind., has become chief engineer for the steel and tube department of the main plant of the Timken Roller Bearing Co., Canton, O.

R. G. Garretson has resigned as chief draftsman with the National Motor Car & Vehicle Corp., Indianapolis, Ind., and has accepted a position as engineer with the Clark Truck-Tractor Co., Buchanan, Mich.

C. L. Criner has been appointed superintendent D. M. Sechler Imp. & Carriage Co., Moline, Ill.

OBITUARY

Elmer Apperson, pioneer automobile builder, and the elder of the famous Apperson Brothers, was stricken with apoplexy on March 28, while watching an automobile race at the Ascot Speedway, Los Angeles. The former president of Apperson Bros. Automobile Co. was spending the winter in California, where he had gone in search of improved health. He died within a few moments.

The elder Apperson had not been active in the company which bears the family name for several years, his health having been poor for a long time. His virtual retirement from business came in December, 1917, when his brother Edgar assumed the management. Prior to that time the business had been run by them jointly from the time of its incorporation in 1903, Elmer serving as president and general manager and Edgar as vice-president and designer.

Apperson's death makes the first break in the ranks of the real pioneers of the automobile industry, and recalls the rivalry that has existed between them for almost thirty years. Apperson Brothers, then operating a small machine shop, built for Elwood Haynes his first car, in 1893, the original conception for which came to him, as the latter asserts, as far back as 1888. Whether the inventive faculties of Haynes or the mechanical adaptability of the Appersons contributed the vital spark to the product, the fact remains that the experiment was sufficiently successful to lure the trio into the automobile manufacturing business under the style of the Haynes-Apperson Co., which was incorporated in 1898.

Activities of Automotive Manufacturers

Where They Are Located What They Are Doing How They Are Prospering

DuPont Motors, Inc., Wilmington, Del., is having plans prepared for its new plant at Moore, Pa., near Philadelphia, where a site of about eight and one-half acres has been secured, on the line of the Philadelphia, Baltimore & Washington Railroad. The initial building will be two stories, of brick and steel, 75 x 790 ft. to be used for assembling and finishing, it being the intention to maintain the present plant at South Wilmington for engine and chassis construction. The company will specialize in the manufacture of two models of pleasure cars, a four-passenger touring car and two-passenger roadster. E. Paul duPont is president and John A. Pierson, chief engineer.

Ryan-Bohn Foundry Co., Lansing, Mich., has been organized to make cylinder castings. The company, which is controlled by D. J. Ryan and Charles B. Bohn, has acquired fifty acres of land, and already has begun a building program that is to involve an expenditure of a million dollars for plant and equipment. Of its principals, Ryan is, of course, known to the trade through his connection with the Allyne-Ryan Co., Cleveland, and the D. J. Ryan Co., Wyandotte, Mich. Bohn is known to Detroit as head of his own Charles B. Bohn Foundry Co., which he formed after leaving the Aluminum Castings Co., where he had been for many years.

Buick Motor Co., Flint, Mich., has arranged a program to total about $10,000,000 for new construction during the present year. Of this amount $7,500,000 will be expended for new buildings and equipment at the local works, while the remainder, $2,500,000, will be used for an assembling plant at St. Louis. Nine new buildings will be constructed at Flint and other enlargements made to allow for a capacity of 550 automobiles per day. The St. Louis plant will be equipped to assemble 200 cars daily, the chassis units being sent to this point for assembling; bodies for the cars will be built at this latter works. H. H. Bassett is president.

Maryland Motors Corporation, Baltimore, which has been organized with $2,000,0000 capital stock, will build a four-story plant, 100 x 400 ft., for the manufacture of motor trucks at Laurel, Md. It also is planned to furnish power for a lighting plant for the town, a pumping plant, an ice-making plant and a sewage disposal plant. The officers of the company are Paul J. Prodoehl, Munsey Building, Baltimore, president; T. B. Webster, vice-president; Howard G. Clark, secretary and treasurer; I. C. Baker, chief engineer; John H. Kunkel, J. H. Ellard and C. W. Ludwig.

Southern Automobile Mfg. Co., 117 Linden Avenue, Memphis, Tenn., recently organized, will have a new plant to consist of a two-story works, 100 x 300 ft., with wing 100 x 200 ft. It will cost about $250,000, including machinery, and it is proposed to develop an output of 20 automobiles a day. W. A. King is president and general manager. Regan & Weller, Bank of Commerce Building, are the architects.

Oshkosh Motor Truck Co., Oshkosh, Wis., has purchased 35 acres at Twenty-Fifth and Oregon streets for its proposed new manufacturing group. Work will begin April 1 on the erection of a one-story brick and steel machine shop and assembling floor, 80 x 320 ft., and an office building, 40 x 60 ft. Inquiry is being made for additional equipment. B. A. Mosling is secretary.

William J. Oliver Mfg. Co., Knoxville, Tenn., is planning for extensions and improvements at its plant to cost about $100,000. A new steel foundry will be erected and the present iron foundry increased in capacity; an addition will be built to the pattern shop. The extensions will be used for the manufacture of tractor parts, and the machinery installation is estimated to total $40,000.

Montana Tractor Co., Chicago, has accepted the offer of the Peshtigo, Wis., Development Club to provide a site for a branch factory, and will start work about April 1 on the erection of a one-story brick and steel assembling shop, 150 x 250 ft., estimated to cost $100,000 with equipment. Charles H. Haight, vice-president, is in charge of operations at Peshtigo.

William Small Co., Indianapolis, has increased the capital stock from $1,000,000 to $3,000,000, partly to enable the company to erect a new building for the manufacture of automobiles at Belmont Avenue and Washington Street. It now operates a motor and axle plant and an assembling and finishing works. W. G. Todd is secretary.

Franklin Tractor Co., Greenville, Ohio, has purchased the entire business of the Bullock Tractor Co., Chicago, and will operate the plant as the Bullock Division. The manufacture of Bullock tractors, models C and G, will be continued as well as the Franklin Flexible tractors. O. C. Parker has been appointed general sales manager.

Wright Aeronautical Corporation of America, 40 Wall Street, New York, has completed plans for its proposed two-story reinforced-concrete plant, 45 x 200 ft., on Meeker Avenue, Newark, N. J., to cost about $350,000. John W. Ingle, 527 Fifth Avenue, New York, is the architect.

Bowen Motor Car Co., Title Guaranty Building, St. Louis, has acquired 21 acres adjoining the city on which it will erect a plant for the production of a gasoline-driven standard-gage railroad car. A. D. Bowen is president. The company has a capital stock of $1,000,000.

Empire Motors, Ltd., Toronto, has been incorporated with a capital stock of $250,000 by William A. J. Case, 801 Dominion Bank Building; James B. Taylor, 78 Belhaven Road; George E. Atwood, and others to manufacture automobiles, airplanes, motor cycles, etc.

Cyclemobile Co., Toledo, Ohio, has been organized with $600,000 capital to manufacture a one-passenger car to sell at $350. Operations have been begun on the plant and work was supposed to start assembling on April 1st. Chas. F. Hamel is president.

Camden Moors Corporation, Collingswood, N. J., has inaugurated operations at its new local plant for the manufacture of ½-ton front-drive motor trucks. Frank Bateman is president; E. S. Bateman, vice-president, and Fred H. Bateman, general manager.

Jones Motor Car Co., Wichita, Kas., will rebuild its factory which was destroyed by fire recently. The two buildings were the paint shop and frame-making buildings, the latter catching from the former to which it was closely situated. The fire took 14 complete cars ready to ship and 100 bodies.

Hare's Motors, Inc., has been organized by Emlen S. Hare, president the Mercer Motors Co., Trenton, N. J., to act as an operating company for the Mercer organization and its affiliated interests, the Locomobile Co., Bridgeport, Conn., and the Simplex Automobile Co., New Brunswick, N. J.

Reliable Tractor & Engine Co., Portsmouth, O., contemplates moving its plant to Cincinnati. A number of sites are in view, and it is stated that the deal will be completed and constructon of the new building started within 60 days. Christian Heer is president and general manager.

Pierce-Arrow Motor Car Co., Elmwood Avenue, Buffalo, is planning for increased production in motor trucks and pleasure cars. For this purpose the expanded plant facilities arranged for Government service during the war will be utilized.

Bethlehem Motors Co., Allentown, Pa., manufacturer of motor trucks, has awarded a contract to George H. Hardner, Lentz Building, for a one-story plant addition, 80 x 380 ft., to cost $100,000 including equipment. Hiram F. Harris is president.

Dort Motor Car Co. has broken ground for the new plant at Flint, Mich., and the building will be ready for operation in August. This will be the first unit of the new organization of the Dort company, which will eventually cover more than 70 acres.

Judson Tractor Co., of New York, has acquired the plant of the Standard Process Steel Co., Broad Street, Phillipsburg, N. J., for its new branch tractor plant. The works will be altered and it is planned to erect a number of new buildings.

Milburn Wagon Company, Toledo, Ohio, has contracted for the wholesale distribution of United States motor trucks, made by the United States Motor Truck Company of Cincinnati, Ohio, for the states of Ohio, Michigan and Illinois.

Transport Truck Co., manufacturer of motor trucks, Mount Pleasant, Mich., has increased its capital stock from $1,000,000 to $5,000,000, with a view to enlarging its plant at once to increase production from 10 trucks per day to 20.

Criterion Motors Co., Indianapolis, has been incorporated with a capital stock of $1,000,000 under Delaware laws by Walter J. Leinbach, Victor R. Chandler and E. Edward Dean, Indianapolis, to manufacture automobiles.

Rainier Motor Corporation, 225 West Fifty-eighth Street, New York, with plant on Bayside Avenue, Flushing, is planning for a plant addition. The project was approved at a recent meeting of the board of directors.

Gale Motors Corporation, Indianapolis, has been organized with $350,000 capital stock and has opened offices at 409 Traction Terminal Building. Gard Gale is president. A plant will be built in Indianapolis.

Preston Motors Corporation, Birmingham, Ala., has increased its capital stock from $1,000,000 to $10,000,000 and is arranging for the erection of a one-story works, 350 x 700 ft., including an electric power plant.

Audrey Motors Corporation, New York, has been incorporated with a capital stock of $500,000 by H. P. Friedman, H. P. Clarke and H. J. Liebeskind, 200 Fifth Avenue, to manufacture automobile motors.

Mercer Motor Co., Trenton, N. J., manufacturer of automobiles, has awarded a contract for two plant additions, two stories, 40 x 80 ft., and one story, 60 x 400 ft., to cost $200,000, including equipment.

Couch-Hass Motors Corporation, 1637 Redfield Avenue, Brooklyn, has commenced the erection of a new automobile manufacturing plant at Henry, Ely and Williams streets, Long Island City, N. Y.

Paragon Motor Car Co., with a reported capital of $3,000,000, has been organized at Connellsville, Pa., and it is said will build a large plant in that city for the building of motor cars.

Hendrickson Motor Truck Co., Thirty-Sixth Street and Wabash Avenue, Chicago, has let contract for a one-story plant, 49 x 83 ft., at 18-24 East Thirty-sixth Street, to cost $9,000.

Commercial Truck Co., Twenty-seventh and Brown streets, Philadelphia, manufacturer of motor trucks, has filed articles of incorporation with a capital stock of $4,000,000.

Oakland Motor Car Co., Pontiac, Mich., has arranged for the erection of additions to its plant to cost about $3,000,000. Three new factory units will be constructed.

Sayers & Scovill Co., Cincinnati, Ohio, has started work on a new plant 80 x 350, three and four stories high, on Spring Grove Avenue, near Winton Place

Garford Motor Truck Company, Lima, Ohio, started work recently on first of the big factory building campaign to cost $750,000 and double is capacity.

Haverford Cycle Co., 503 Market Street, Philadelphia, manufacturer of bicycles, parts, etc., has increased its capital stock from $350,000 to $500,000.

Leonard Tractor Co., Gary, Ind., has bought 106 acres at Griffith, Ind., and contemplates the erection of a $200,000 one-story steel structure, 100 x 250.

Ford Motor Co.'s Milwaukee, Wis., plant has increased its daily output from 140 to 160 complete cars, or approximately at the rate of 50,000 per year.

Parts Makers

Anderson Motor Corporation, 116 Robbins Street, Waltham, with a capitalization of $10,000, has been chartered to conduct a general foundry and machine shop business. It is a successor to Anderson & Co., manufacturers of automatic carburetor attachments for Ford cars and of automobile specialties. The new company will specialize in an automatic air adjuster, gasoline strainer, and a heating device. The management contemplates securing new and enlarged quarters within the near future and the manufacture of marine engines and a die holder will be undertaken. Andres A. Anderson is president and treasurer.

Standard Parts Co., Cleveland, is carrying out the plans of the new management to dispose of certain branches and ultimately to concentrate its business near the center of operations, has sold its new spring plant at Flint, Mich., to R. T. Armstrong, the purchase price being approximately $900,000. It is stated that Mr. Armstrong purchased this plant on his own account rather than representing some automobile interest. The Standard Parts Co. in its refinancing plans, has arranged for a $6,000,000 loan to be taken by Cleveland and New York banks and investment security houses.

Highways Motor Co., Defiance, Ohio, has been organized with a capital stock of $1,500,000 to manufacture motors for passenger cars and trains. It is stated that the company plans to take over two Detroit companies engaged in this line of manufacture. C. H. Kettenring, R. P. Kettenring and T. T. Shaw, Defiance; J. W. Swartz, J. W. Wright, W. R. Fruchey and A. M. Pearson, Detroit; A. R. Fraser, Cleveland, and H. S. Reynolds, Toledo, are directors.

Duplex Engine Governor Co., 36 Flatbush Avenue Extension, Brooklyn, is negotiating with the Chamber of Commerce, Dover, N. J., for the establishment of a new plant in that city. It is proposed to acquire a three-acre tract in the eastern part of the city, with erection of an initial building, one-story, 100 x 350 ft., to cost about $100,000, including equipment.

Clarotto Mfg. Co. of Milwaukee is a new corporation organized with an authorized capital stock of $1,000,000 by O. G. Pfeifer, Thomas C. Hanson and W. A. Kuebler, 3803 North Avenue. It will engage in the manufacture of gasoline engines, motor vehicles, parts and accessories. Further plans are not available at present.

Greene Carburetor Co., Boston, capitalized for $50,000, has been chartered. It has a contract for the manufacture of a gasoline carburetor, and is negotiating for a plant. Walter T. Geene, 336 Belgrade Avenue, Roslindale, is president, and Henry J. Barry, 40 Court Street, Boston, treasurer.

Brown Instrument Co., Wayne and Windrim streets, Philadelphia, manufacturer of pyrometers, etc., has filed plans for a two-story concrete addition, 44 x 126 ft., to cost about $35,000. A second addition of similar type, two-stories, 37 x 72 ft., will be erected at a cost of about $22,000.

Merchant & Evans Co., 2035 Washington Street, Philadelphia, manufacturer of tin plate specialties, metal roofing, etc., has acquired about 21 acres at Lancaster, Pa., for a new branch plant. It is proposed to inaugurate construction at an early date.

Acme Storage Battery Corporation, Poughkeepsie, N. Y., which recently increased its capital stock from $100,000 to $175,000, has changed its principal product from house lighting batteries to starting and lighting batteries of the automobile type.

Adjusto Mfg. Co., Brooklyn, has been incorporated with a capital stock of $40,000 by Edward N. Smith, Burant J. Thompson, Brooklyn, and H. A. Stewart, New York, to manufacture adjustable metal frames for automobile wind shields, etc.

Auburn Ball Bearings Co. and the M. K. Knowlton Co., Rochester, N. Y., manufacturers of machinery, have acquired the three-story brick building on Industrial street adjoining their works and are making extensive alterations.

Johnson Specialty Co., 616 East Washington Avenue, Madison, Wis., has been organized by Orvey Johnson to manufacture a patented device for expanding piston rings and other appliances for automatic plants and garages.

General Aluminum & Brass Mfg. Co., East Grand boulevard, Detroit, is planning for the immediate erection of a one-story building at Marysville, Mich., 350 x 450 ft., to cost about $75,000. F. C. Root is vice-president.

Fuller & Son Mfg. Co., North Pitcher street, Kalamazoo, Mich., manufacturer of gears for automobiles, has broken ground for a four-story addition, 50 x 140 ft., at Pitcher and Prouty streets. W. H. Fuller is president.

Tuthill Springs Co., manufacturer of automobile springs, 760 Polk street, Chicago, has awarded the general contract for a one- and two-story plant, 212 x 418 ft., at West 31st street and Kilbourn avenue, to cost $200,000.

Pro-Mo-Tor Fabricating Corp., 182 Locust Avenue, Bronx, N. Y., has succeeded to Herz & Co., manufacturers of Herz spark plugs, Bougie Mercedes spark plugs, air compressors, magnetos, wire and cable terminals.

Timken Roller Bearing Co., which is constructing a large plant at Columbus, Ohio, has purchased an adjacent tract, 80 x 600, and ordered plans for additional buildings to cost about $500,000.

Liberty Mfg. Co., Elm Street, Bridgeport, Conn., manufacturer of automobile motors, is planning for the erection of a new plant to cost about $100,000, including equipment.

Warner Corp., Muncie, Ind., has been incorporated for $250,000 to manufacture automobiles. J. F. Warner, W. M. Sample and D. O. Skillen are the incorporators.

Lycoming Foundry & Machine Co., Williamsport, Pa., will build a plant addition, and make alterations in its machine shop and foundry to cost about $150,000.

Novo Engine Co., Lansing, Mich., will shortly begin the erection of a two-story factory addition, 120 x 200, to be used as a machine shop and foundry.

Universal Battery Co., Chicago, has purchased a new factory site, 120 x 165, and will build thereon a two-story plant to cost $100,000.

Sheldon Axle Co., Scranton, Pa., has completed plans for a three-story addition, 100 x 200 ft., on Beaumont Street, to cost about $200,000.

Bessemer Gas Engine Co., Grove City, Pa., will build a new foundry and pattern shop and a number of houses for its employes.

Safety Steering Gear Co., Superior, Wis., has been incorporated with a capital stock of $100,000, to manufacture devices for motor vehicles, tractors, etc. M. E. Benson is the principal incorporator.

Bullard Machine Tool Co., Bridgeport, Conn., contemplates the erection of a forge shope 70 x 208 ft., and a two-story administration building, 60 x 200 ft., to cost approximately $175,000.

Covert Gear Co., Lockport, N. Y., manufacturer of automobile gears and transmission, has awarded a contract for a three-story addition to cost about $250,000, including equipment.

Economy Carbureter Co., Milwaukee, has amended its articles to provide for an increase in capital stock from $50,000 to $75,000. A larger output is being arranged for.

Lauraine Magneto Co., 1765 Broadway, New York, has acquired a factory, 100 x 150 ft., on 13th street, near Van Alst avenue, Long Island City, for a manufacturing plant.

Brewer-Tichner Corp., Binghamton, N. Y., has prepared plans for a factory for the manufacture of automobile tops, to be erected at an estimated cost of $150,000.

Hercules Motor Mfg. Co., Canton, Ohio, has increased its capital from $500,000 to $750,000.

Body Builders

Martin-Parry Corp., through F. M. Small, its president, expects to produce 100,000 motor truck bodies during the coming year, with production capacity doubled at its plants in Indianapolis, Ind., and York, Pa. To a doubling of the equipment at the latter plant, which is to be in full operation by April, there is to be added a doubled plant at Indianapolis, recently approved by the board. This will involve merely extra machinery, since the buildings are reported to have ample floor space.

A site has been purchased for a new factory in Coopersville, Mich., for the manufacture of motor truck bodies and cabs and buildings will be erected immediately. Local capitalists are back of the new company, which has a capital stock of $8,000. The officers are: President, John H. Teravert; vice-president, L. J. Hinken; secretary-treasurer, William Van Allsburg; manager Millard Bush.

Superior Body Co., Rahway, N. J., has been capitalized at $500,000, all common stock of $5 par value, to take over an old copartnership of the same name. The company is completing the construction of additional plants which are required to help fill the $8,000,000 worth of orders now on hand.

American Automobile Body Mfg. Co., Newark, N. J., has filed notice of organization, with office at Commerce and Market streets, to manufacture automobile bodies. C. C. A. Reetz, 820 Grove Street, Elizabeth, N. J., and George S. Dougherty, Flushing, N. Y., head the company.

C. Spiro Mfg. Co., a New York corporation, has leased part of the former plant of the Diamond Chain & Mfg. Co., Indianapolis, and will establish works for manufacturing running boards for automobiles. A factory will be erected later.

Drayer & Hanson Co., 743 East Fourteenth Street, Los Angeles, has been organized to manufacture truck and automobile pleasure bodies, parts, etc. H. E. Drayer and Bert Hanson, head the company.

Gary Auto Body Mfg. Co., Gary, Ind., has been incorporated with $250,000 capital stock to manufacture automobile bodies. The directors are Franklin T. Fetterer, Walter M. Staley and William B. Levey.

G. Elias & Brother, 965 Elk Street, Buffalo, operating a woodworking plant, are planning for immediate establishment of a department for the manufacture of airplanes and parts for military service.

McCabe-Powers Carriage Co. has purchased the four-story building at 1215 North Broadway, St. Louis, Mo., which it occupies. It was owned by P. D. C. Ball. The consideration was $50,000.

Balch Body Corporation, Utica, N. Y., has been incorporated with a capital stock of $25,000 by F. W. and F. E. Balch, and H. J. Dillenback, to manufacture automobile bodies.

T. B. Taylor and J. O. Douglas, Alma, Ga., are organizing a company for the establishment of a local plant for the manufacture of automobile truck bodies.

Otto Sellow Mfg. Co., manufacturer of automobile bodies, 2730 Elston Avenue, Chicago, has let contract for a one-story plant, 63 x 97 ft., to cost $19,000.

Karges Wagon Works, Evansville, Ind., has ordered plans for two one-story factory buildings, 60 x 200 and 65 x 75, respectively.

McRary & Son, Asheville, N. C., will build an addition, 60 x 80 ft., for the manufacture of truck bodies. W. S. McRary is manager.

Automotive Body Co., Wauseon, Ohio, has acquired a site and will erect a plant for the manufacture of automobile bodies.

Brewer-Tichener Corporation, Binghamton, N. Y., is plannng for a one and two-story addition, 70 x 300 ft., to cost $85,000.

Additional Personal Notes.

John Perkins, who has been superintendent of the truck division, Packard Motor Car Co., Detroit, has been placed in charge of production of the Lewis-Hall Motors Corp., Detroit, which has just been separated from the Lewis-Hall Iron Works.

James A. Edwards, who was formerly aeronautical engineer with the Hall-Scott Motor Car Co., San Francisco, Cal., has accepted a position as assistant engineer in the engine laboratory of the Associated Oil Co. of California, Oakland, Cal.

L. M. Smith and C. J. Craven, both formerly wth the Standard Motor Truck Co., Detroit, have joined the Detroit Transportation Truck Co., the first as production manager, the second as manager of the manufacturing stock department.

P. F. Hackethal has resigned as assistant chief engineer of the Templar Motors Corporation, Cleveland, Ohio, to accept the position of vice-president and chief engineer of the Paragon Motor Car Co., Connellsville, Pa.

Paul E. Ryan, for the past year production manager of the Aluminum Castings Co., Cleveland, has been made manager of the Perfection Spring Division of the Standard Parts Co. He succeeds in that post J. B. Childe.

C. T. Fuller has resigned as management engineer with Frank B. Gilbreth, Inc., Providence, R. I., and has accepted a position as production manager with the Watson Products Corporation, Canastota, N. Y.

L. E. Butzman has accepted a position as assistant chief engineer with the Tool & Auto Products Co., Cleveland, Ohio. He was formerly in the employ of the Grant Motor Car Car Corporation, also of that city.

C. A. White has resigned as order department manager of the American Tube and Stamping Co., Bridgeport, Conn., to return to his former position as purchasing agent for the Hero Mfg. Co., Philadelphia.

W. T. Marsh is president of the Marsh Motor Car Co., the latest entrant in Cleveland's automobile manufacturing field, which has acquired a plant on Ridge road and the Cleveland Short Line railway.

Charles S. Crawford has been appointed vice-president in charge of engineering with the Premier Motor Corp., Indianapolis, Ind. He was formerly engineering director and assistant general manager.

W. J. Cleary, of the purchasing forces of the Studebaker Corp., Detroit, has been made purchasing agent of the Willys Corp. at its Elizabeth, N. J., plant. Cleary assumed his new post Jan. 15.

Russell W. Stovel has been appointed consulting engineer of Westinghouse, Church, Kerr & Co., Inc., New York, and will devote his time to the company's electrical and mechanical work.

A. H. Martin has been elected secretary and general manager of the International Steel Products Co., Hartford, Wis. He was formerly chief engineer of the Kissel Motor Car Co., also of that city.

Romould Karasinski has been appointed assistant chief engineer of the Paragon Motor Car Co., Connellsville, Pa. He formerly held a similar position with the Cleveland Automobile Co., Cleveland, O.

Horace E. Dodge has been elected a member of the board of directors of the National Automobile Chamber of Commerce, filling the place left vacant by the death of his brother, John F. Dodge.

G. C. Weyland has been advanced to the position of vice-president in charge of sales of the J. I. Case Co., Racine, Wis. In this capacity Mr. Weyland succeeds L. N. Burns, who has resigned.

A. R. Clas, president of the Toledo (O.) Steel Products Co., has been elected a director and vice-president of the recently incorporated Toledo Automotive Products Co., also of that city.

Boyd Fisher announces his withdrawal from consulting practice with a group of consulting engineers at Philadelphia in order to devote his entire time to the Aluminum Castings Co.

Charles G. King has resigned as factory superintendent of the Le Roi Co., Milwaukee, Wis., and is now engaged in development work with the Miles Piston Ring Co., Chicago, Ill.

D. C. Goff has resigned as assistant sales manager of the Winther Motor Truck Co., Kenosha, Wis., and has accepted a position with the Leftwich Motor Co., Lynchburg, Va.

C. W. Bassett, formerly assistant manager Budd Wheel Corporation, Philadelphia, has entered the production department of the Bethlehem Steel Co. at Bethlehem, Pa.

E. R. Finkenstaedt, for a number of years assistant to Christian Girl, president of the Standard Parts Co., Cleveland, has resigned, following the retirement of his chief.

Harry L. Bill, formerly with the Winton Motor Car Co. of Cleveland, has become vice-president and general manager of the Saxon Motor Car Corporation, Detroit.

Frank A. Turner, chief engineer Becker Milling Machine Co., Hyde Park, Mass., has become chief engineer of the Flexible Automotive Tire Co., Boston.

O. L. Curtis has resigned as engineer and sales manager of the Racine (Wis.) Mfg. Co., to accept a position with the Ligonier (Ind.) Auto Body Co.

L. M. Lloyd, former advertising manager, has been made president of the Edward A. Cassidy Co., succeeding E. A. Cassidy, who died recently.

Stephen O. De Orlow has accepted a position in the research laboratory of the General Motors Corp., Detroit, Mich.

K. W. Hocth has accepted a position as chief engineer with the Detroit Transmission Co., Detroit, Mich.

W. W. Mountain has been appointed vice-president of the Wright Roller Bearing Co., Philadelphia, Pa.

Tungsten and Tin from Burma

Tungsten and tin occur in Burma and mining on a small scale, particularly for tin, is an ancient industry. Military need for tungsten has caused general interest in the world's resources of the metal and has caused the Geological Survey of India to publish a summary, prepared by Messrs. Brown and Heron, on the deposits in Burma.

Active prospecting has been carried on in recent years and a considerable amount of tungsten has been produced. Usually wolfram and casiterite occur together, but sometimes they occur separately. The ores are found in lodes and are always associated with an intrusive granite that forms the core of the great mountain system which stretches into western Siam and the Malay States. The authors believe that conditions are favorable for the discovery of further deposits in the vast areas of Burma which are as yet imperfectly known.

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WANTS

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Trailers Increase Transportation Efficiency

By DONALD McLEOD LAY

Reduce Haulage Costs 15 to 50 Per Cent—Many and Varied Applications—Origin and Development of the New Industry in the Automobile Field

ONE of the newest, and at the same time most flourishing, industries in the automotive field is the manufacture of trailers. These economical vehicles have proved themselves such potent factors in the reduction of haulage costs in all sorts of applications that they are coming into wider and wider use, not only in connection with motor trucks of various sizes and load capacities but also with passenger automobiles. This wide use is creating a nice business for many body builders.

Although the trailer industry is only six or seven years old, there are more than seventy-five manufacturers of these auxiliary vehicles in the United States. Of these one-third are doing business on a national scale and a number of them are shipping trailers of various types to overseas countries. At present, the industry centers in the United States, the making of trailers being extremely limited in European countries.

Use by Automotive Manufacturers

Trailers are used extensively by many of the manufacturers of automotive products, as they have been found valuable for hauling loads of parts, material, supplies equipment, etc., between the factories, to and from railroad lines and other points nearby. Each trailer used in connection with a motor truck doubles the useful load at least and, in many cases, triples it. This has resulted in a marked saving not only in the reduced cost of transtation, but in the time required to haul a givenquantity of material, parts or whatever the load might be.

Fig. 1. One of a number of trailer outfits used by the Ford Motor Company, Detroit. Note the bulky load on the trailer.

The Principle of the Trailer

The fundamental principle of the trailer may be said to be that a motor vehicle can pull much more than it can carry, the same as a steam locomotive. The first adaptation of the idea to road transportation, according to records available, was the practice begun more than twenty years ago by users of steam road tractors in England of pulling trains of two to six wagons behind these power vehicles in hauling large quantities of products of the farm and bulky loads of merchandise. Although the use of trailers has been continued to some extent, no great development in the manufacture and use of trailers has occurred in Great Britain or other foreign countries.

Development in the United States

In the United States, however, the use of ordinary horse-drawn wagons towed behind traction engines in road construction work led to the development of special road tractors of both the gasoline-driven and electric types. About a dozen years ago one of the pioneer motor truck manufacturers produced a three-wheel gasoline road tractor for use with wagons of the horse-drawn variety, the front wheels and axle of the wagon being removed and the front end being supported on the rear of the tractor. Flexibility for turning was provided vided by a fifth

Fig. 2. Two-wheel trailer for animals pulled by Ford Roadster, This outfit has hauled cows, calves, bulls to one ton in weight. lumber, grain, large trees, wood, coal and many other products.

wheel arrangement. Not long after this, a concern building frontwheel and four-wheel-drive electric trucks came out with a four-wheel tractor and also a two-wheel front-drive mechanism for tractor purposes.

Ordinary Wagons Unsuitable

Wagons of the horse-drawn type could not withstand the shocks and vibration to which they were subjected at the increased speed attained by the tractor. Their iron tires caused them to bounce and rattle over the roads and the plain bearings became overheated, so it was not long before the effects of this wear became so marked that heavy and frequent repairs were necessary. In spite of the care and money spent in keeping the wagons in condition, it became apparent that they could not perform efficiently under conditions for which they were not designed or built.

With the conclusion that specially-built trailers, capable of withstanding the severe conditions imposed by higher road speeds, would prove valuable auxiliary vehicles to be used in connection with road tractors, motor trucks and automobiles, came the decision of a well known wagon manufacturer to profit by the experience of the automobile industry. Accordingly, automobile engineering principles were applied to the problem and the result was a line of real trailers for motor trucks, incorporating steel frames, artillery type wheels, rubber tires and steering-knuckle axles fitted with roller bearings. The success of these new vehicles inspired a number of other long-established wagon and carriage companies to develop various types of trailers to meet the growing demand and to take up the slack in their business caused by the decline of the horse-drawn vehicle industry.

Based largely on the automobile and motor truck industries, and utilizing as it does the general principles, material, stock, dimensions and other standards perfected by them, the trailer business has shown a rapid and healthy growth. While the aggregate volume of output representing the seventy-five manufacturers in the field today does not loom very large as compared with the production of automobiles and motor trucks, sales of trailers are increasing 100 per cent or more a year. There are approximately 30,000 trailers in use in the United States and the demand for them is spreading so rapidly, especially in the central and western States, that the manufacturers are expanding their fcilities, and a number of new companies are entering the business.

During the war, trailers proved their worth in transportation to both the army and navy. More than 30,000 trailers were supplied to the United States government during 1917 and 1918. These included kitchen, repair shop, baggage and supply, ammunition, artillery and searchlight trailers, etc. Of the 5,500 which were shipped to France, those which were in serviceable condition at the time the American army was withdrawn in 1919 were transferred to the French government. The sight of trailers in every day use in camps all over the United States, as well as the frequent appearance of trailers in war pictures and parades, did much to suggest their practicability as peace-time utilities to the American people.

Trailers now on the market include a wide variety of types and capacities for all purposes, ranging from the small compact two-wheel trailer equipped with pneumatic tires and with a load capacity of 500 pounds for attachment to touring cars and runabouts, to trailers and semi-railers of 10 to 15 tons capacity designed to be hauled by powerful motor trucks and road tractors. There are a few specially-built trailers in use which are capable of carrying loads of 40 to 50 tons. Practically every manufacturer of heavy trailers includes in his line one or more models of pole and pipe trailers for transporting long, unwieldy telephone poles, pipe, timbers, rods, structural beams and similar objects, ranging from 15 to 65 feet or more in length. There are all sorts of special dumping trailers for use in hauling lumber, coal, crushed stone and other loose material and also special types for carrying ice and ice cream, groceries, etc. Several companies have recently expanded their lines by the addition of drop-frame trailers with side-dump bodies, and a number of manufacturers have developed very compact, yet complete, camping trailers for use on tours and outings by automobile. The equipment includes a folding tent, beds, tables, chairs, oil stove, ice box and a full set of cooking requisites.

Just as in the case of the motor truck chassis, any desired type of body of suitable dimensions may be mount-

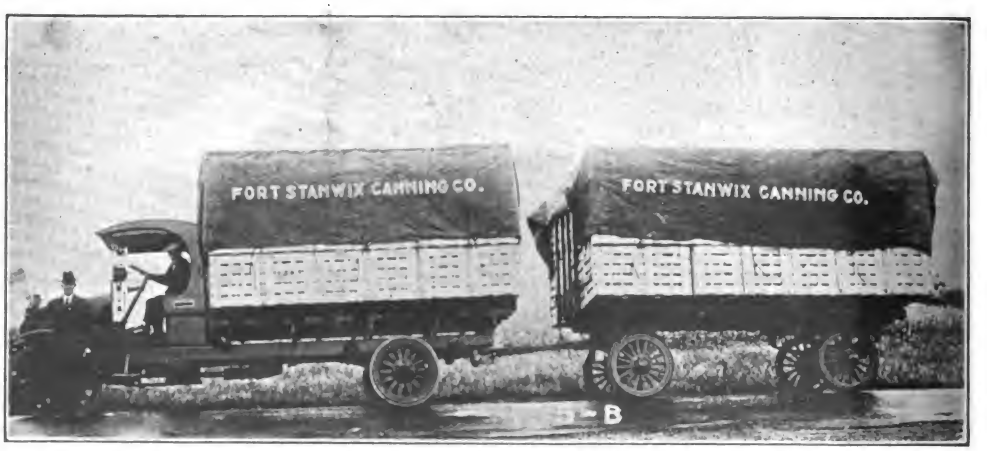


Fig. 3. Truck and four-wheel trailer found very useful by canning company. The outfit hauls 23,000 cans or one railroad car load per trip.

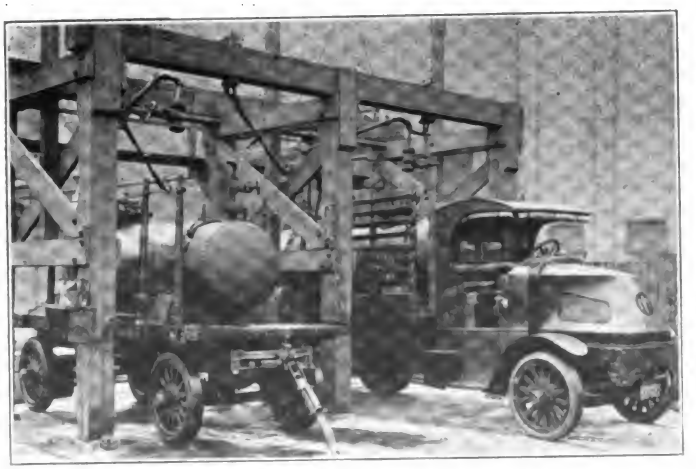


Fig. 4. Four-wheel tank trailer. Note arrangement for filling both trailer and truck tanks at the same time

ed on a trailer chassis, provided there are no peculiar features of construction of either which will prevent their combination. A few of the bodies worth mentioning, to indicate the wide range of types in use, are: refrigerator bodies, hearses, fire apparatus, cattle racks, oil and water tank bodies, lumber bodies with roll-off, furniture vans, wood and steel dump constructions and bus bodies with seating accommodations for 70 to 100 passengers.

Four Types of Trailers

Trailers built for use in connection with passenger cars and motor trucks may be divided into four general classifications: two-wheel trailers; semi-trailers; four-wheel trailers; and pole and pipe trailers.

Two wheel trailers are usually light vehicles intended for use behind touring cars and roadsters. Their load capacity ranges from 500 to 3,000 pounds and they are used for the most part by small farmers for work around the farm and for trips to town, by retail merchants for delivery work and by camping tourists. In trailers of this style, the axle is located under the center of the body and none of the weight is supported by the automobile which pulls it. The construction is very simple, consisting of a pair of wood wheels mounted on an axle supporting a body which is generally of wood in box, flare-board or rack style. The trailer is attached to the towing vehicle by means of a tongue or drawbar, 4 to 6 feet long. The lighter and cheaper models have carriage type wheels fitted with plain, ball or roller bearings and steel, cushion or solid rubber tires. The larger and more expensive types are equipped with automobile axles, wheels and springs, with ball or roller bearings and solid or pneumatic rubber tires. Some have all steel bodies and most of them are equipped with folding legs or stands at the front to support the trailer when detached from the automobile. Incidentally these trailers are built for automobile speed.

Some makers are now producing trailers of the two-wheel type in 2 to 5 tons capacity for use behind motor trucks. Models for hauling lumber are made with hinged tongues which makes it possible to dump the entire load at the rear by releasing the tongue lock and backing the truck slightly.

Semi-Trailers Are Larger

Although semi-trailers are made in all sizes from 1 to 15 tons capacity, the larger sizes predominate, the 1 and 2-ton sizes being made for use with passenger cars, usually with some modification, and the others being intended for motor truck application. In this form there are also but two wheels on the trailer but they are located under the rear end and the front end is supported on the rear of the towing machine. The semi-trailer was developed originally by motor truck engineers and this type is manufactured mostly by companies concentrating on the production of trailers.

In use, the rear of the passenger car body, or the entire load-carrying body of the motor truck, as the case may be, is removed and the lower part of a fifth wheel is mounted in the frame. The upper part of the fifth wheel is secured to the under-side of the front end of the semi-trailer and on connecting them, the outfit becomes a six-wheel unit capable of carrying two to three times as much as the hauling vehicle alone could transport. The degree of increase in load depends to a large extent on the charactr of the roads over which the vehicles travel. Highest efficiency is obtained where the roads have hard, dry surfaces and grades are moderate. This doubling or tripling of load capacity makes the use of a semi-trailer very economical. For example, with a semi-trailer attached, a one-ton truck becomes a two or three-ton transportation unit, the cost of operation being increased but slightly due to the somewhat larger consumption of fuel and oil and increase in tire wear on the driving wheels.

How Fifth Wheel Operates

It is the fifth wheel that makes the semi-trailer practical. This is similar to the fifth wheel used in wagon construction and operates in much the same way, allowing the towing vehicle to turn under the front end of the trailer just as the front axle and wheels of a wagon are free to turn under the forward end of the body. But the fifth wheel used in semi-trailers has an additional advantage in that one of the rings is mounted on a transverse

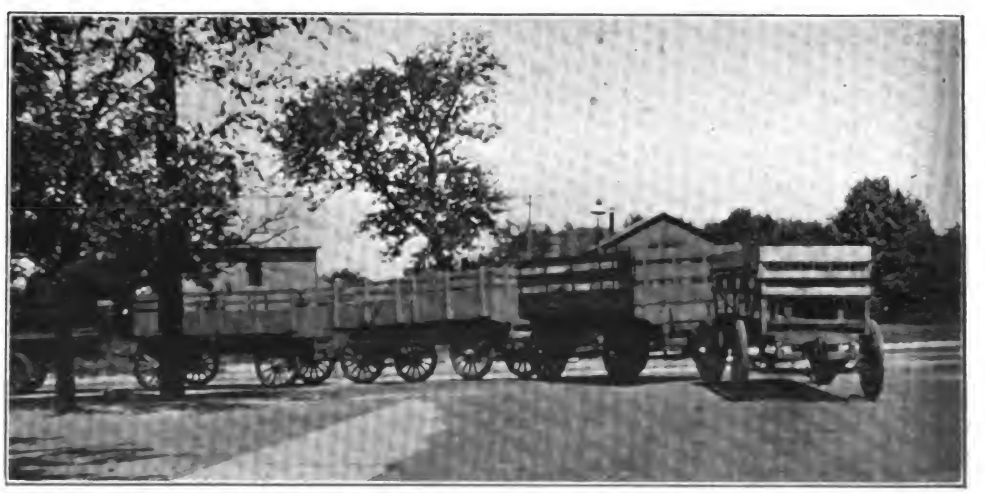


Fig. 5. Train of four-wheel trailers making a turn in which each tracks with the trailer ahead Used by a Cleveland grocery concern to distribute to its branch stores in Lorain and Amherst.

shaft journaled either on the truck or trailer so that it will rock backward and forward, permitting the wheels of the truck and the trailer to traverse even surfaces without breaking the connection. Universal action, which permits tipping sideways as well as backward and forward, is a feature of the construction of some makes. Stiff coil springs are ordinarily provided to take up the shock of starting the trailer and its load and to absorb the road stresses set up in action. The ease with which semi-trailer fifth wheels can be coupled and uncoupled is a marked advantage in saving time. Sometimes a strong kingpin and locking device are used and in other instances a ball and socket connection is employed. In the latest types, coupling and locking are accomplished automatically by merely backing the truck under the trailer.

Four-Wheel Trailers

Operating requirements of the four-wheel trailers are somewhat different from those of the other types as they must be steerable ,must track with the towing vehicle, must not wobble or sidesway, must back readily into any position and must be connected to the towing vehicle by a spring drawbar that can be coupled and uncoupled instantly. As a result, the four-wheel trailers embody more engineering features than other types of trailers.

The general range of four-wheel trailers is from 1200 pounds to 10 tons load capacity, sizes up to 2000 pounds capacity being usually intended for use with passenger cars and the larger sizes for use with motor trucks and tractors. In this type of trailer the entire load is carried on the four wheels.

Motor Truck Design Followed

Some four-wheel trailers are similar to horse-drawn trucks, having rigid front axles, which with the wheels, turn as a unit on a fifth wheel. Most of the manufacturers, however, have followed the motor truck design incorporating steering knuckle axles, the tierod being linked with the drawbar so that the front wheels steer by the change of direction of the drawbar. The drawbar is usually arranged with a large slot connection permitting sidewise movement of the drawbar but preventing vertical movement. It has a bumper head like that on a freight car and strong compression springs are generally provided to take up shocks and stresses.

Four-wheel trailers are made in both reversible and non-reversible types, the reversible trailer having steering-knuckle axles and the same drawbar and steering connection mechanism at each end. Automobile parts are used for the manufacture of most of the lighter four-wheel trailers but for the heavier types motor truck parts are employed because of their greater strength.

The towing vehicle carries its own load when a four-wheel trailer is used, the trailer load sufficing to double the capacity of the towing vehicle alone. These trailers weigh from one-third to slightly more than one-half their greatest carrying capacity and reduce the ton-mile cost of haulage from 15 to 23 per cent.

Pole and Pipe Trailers

There is some similarity between pole trailers and semi-trailers in that they have two wheels and the front end of the load is carried on the rear end of the towing vehicle. There is no body, the load being held in place by bolsters, one on the trailer and the other on the tractor. The tongue or reach of the trailer is adjustable to handle material from 10 feet to 50 feet or more in length. Loads of one ton or more are usually hauled by passenger cars with this type of trailer, one or two-ton trucks being used to pull loads of two to five tons, 30 to 50 per cent of the weight being supported by the towing vehicle.

Fig. 6. Semi-trailer with special body for hauling twelve automobile bodies in a single load

Truck Makers Approve Use of Trailers

At one time motor truck manufacturers opposed the use of trailers with their regular models except under highly favorable working conditions, but the practical results obtained by the use of trailers with their trucks have convinced the manufacturers that these vehicles are valuable factors in road transportation. Approximately twenty-five truck manufacturers have developed road tractors with short wheelbases especially for hauling trailers and semi-trailers. One company equips all its worm-drive trucks with a spring drawbar for pulling trailers. The distribution of weight between truck and trailer has made it possible to transport heavy loads and long and awkward materials and objects, without danger of injury to either vehicle.

General Utility Delivery Body for Ford Chassis

THERE probably is no chassis made which has been used as widely as the Ford, both for range of uses and range of countries and people using. For the man who can spend little money, the average grocery store for instance which boasts but one one-horse delivery wagon, a Ford chassis either new or second hand, with a light delivery body such as is shown below, makes an ideal delivery system. It gives the owner more speed, more deliveries, a greater radius of action, and cheaper delivery. Any boy that can drive a horse can learn to drive a Ford in an hour or so; the care and attention which it needs are almost negligible. Best of all, the body shown is one which any body builder can make in a short time, and can sell at a good profit.

Bodies of this general appearance are seen all over the country, says the Blacksmith and Wheelwright, knocking around and carrying almost anything from a couple of "rush" grocery orders to an emergency load of coal. Yes, such a body will hold and carry a three-quarter ton load of coal easily, but it isn't advisable to do it continually.

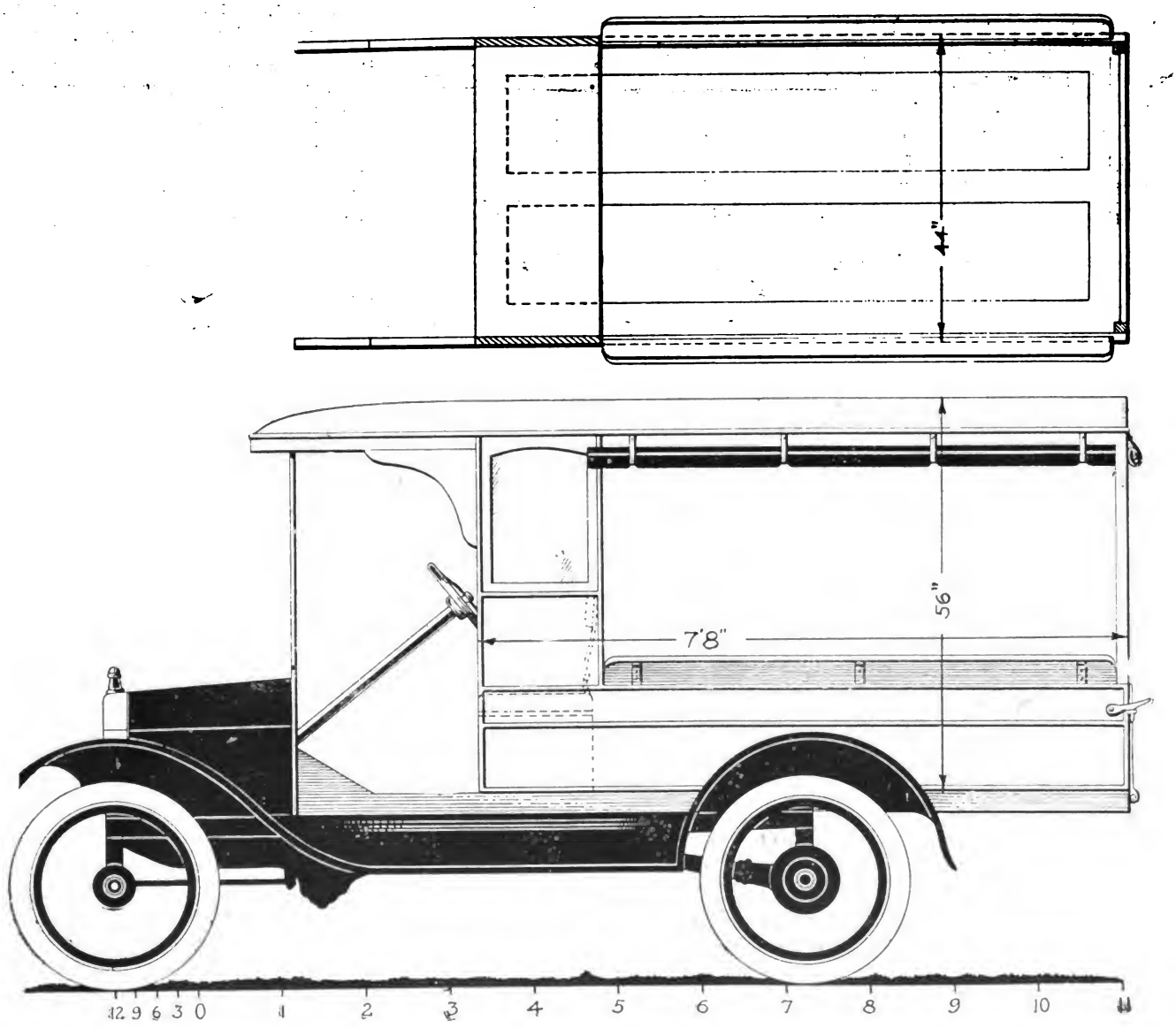
Grocers, butchers and small tradesmen find this body deal for their work, and many larger dealers are maintaining fleets of them, where their loads are usually half a ton or less, and quick handling is essential. There is no getting around the fact that the little Flivver with a light body can skip around pretty fast, and get into places that other trucks cannot.

The army recognized this fact, and many thousand Fords with bodies similar to the one shown below were on the job in France, running here and there with the light loads; and materials were delivered safely by these little Flivers to places where nothing else could penetrate.

The writer knows of one such light delivery Ford that got on the job in France in the fall of 1917 and was still in service in April, 1919. The chauffeur had painted three service stripes and two wound stripes on the right and left sides of the cowl. The body had been hit by shrapnel on two different occasions.

There are many light bodies for the Ford chassis, all designed more or less for light delivery work, and differing from each other only in minor details, due to the individual tastes or requirements of the users. The one

(Concluded on page 32)



General utility delivery body for Ford chassis is simple and easy built.

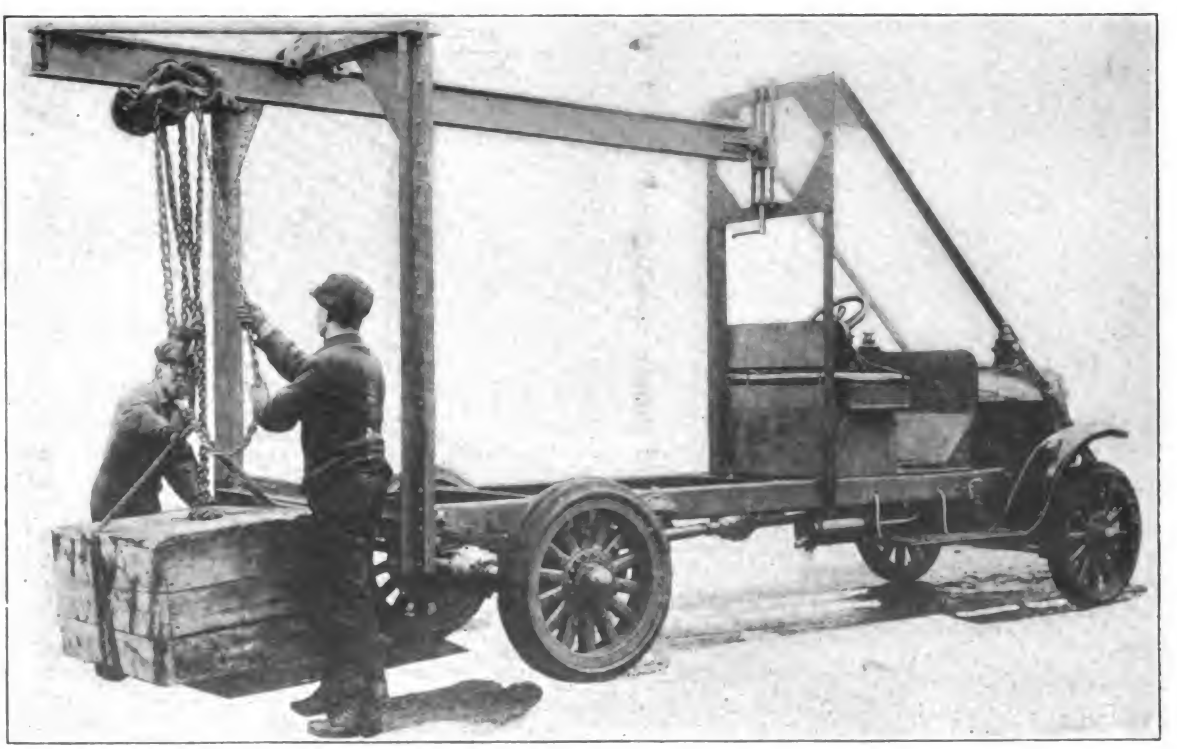
Widening the Field of Utility of the Motor Truck

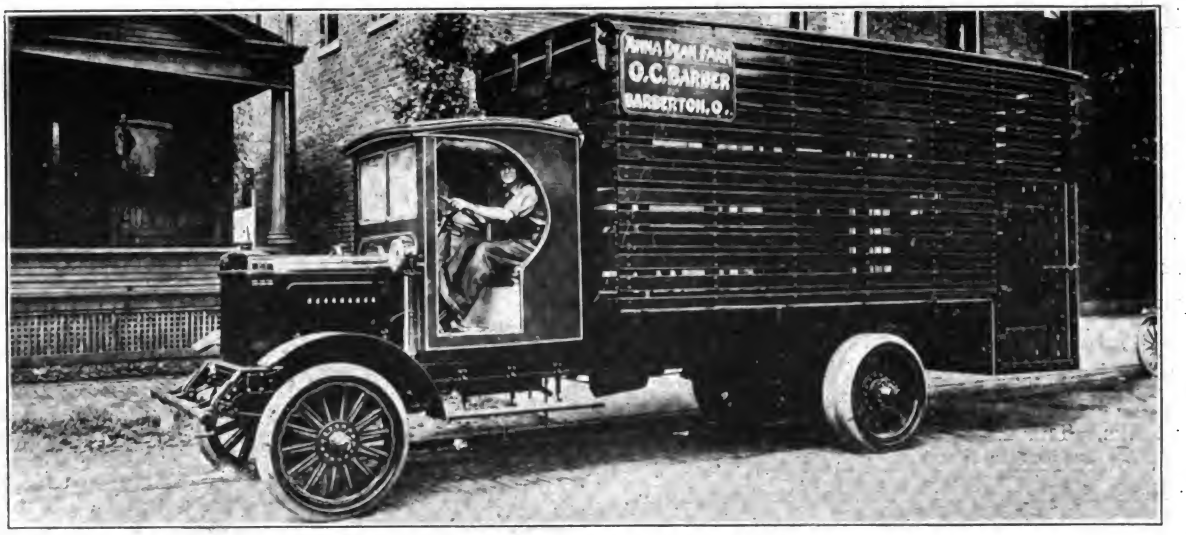
In many different fields of work, the motor truck, with a different or unusual body, is being used for some new or different work, for which it was previously considered impossible. There is scarcely a field of human endeavor in which it is not making daily progress.

Upper photo shows Republic orchard sprayer, mounted on 2½-ton chassis. Tank has a capacity of 6,000 gals. and with it a driver and two men spray 250 trees an hour at 300 lbs pressure.

Middle photo shows F W D repair shop mounted on regular chassis. Extensively used during the war, this layout should prove popular with highway commissions, railroads, etc.

Lower photo shows the Hendrickson crane developed especially for motor truck use, mounted on a Master chassis. The crane saves time and labor in loading and unloading.





This double decked stock body mounted on a Service 3½-ton chassis, is used for transporting live stock to and from the famous Anna Dean farm at Barberton, O. Upper deck is removable for small loads.

By constructing the delivery car body to stimulate the product, much valuable advertising is gained as the vehicle goes on its rounds. This Stewart 1-ton chassis has a special body built for Landay, the phonograph dealer of New York, with the middle portion like a huge Victrola.

Lower photo shows first motor truck equipped with electric crane with magnet. The owners are scrap dealers in Detroit. Generator gives lifting capacity of 500—1,500 lbs. This outfit is said to do work formerly done by 15 laborers.

Gasoline-Driven Snow-Removing Machine Resembles Tank

Gigantic Machine With Very Large Capacity Proves Its Ability in New York Test to Handle Five Tons of Snow and Ice Per Minute

SHORTLY after the last great snow storm, which blanketed New York and many other large cities, and practically stopped the use of the streets for the better part of a week, as well as doing much other damage to property, to transportation companies, and causing huge losses of perishable provisions, etc., there appeared in New York a new form of tank, a peace tank to replace the war tanks. This machine despite its remarkable size and bulk showed remarkable speed in moving around, and more particularly in removing the snow and ice from the streets.

The new machine, shown in Figs. 1 and 2 herewith, is the invention of Dr. Samuel Friedman, East 93rd Street, New York. It was designed and constructed with the idea in mind of removing the snow and ice from the pavement by means of a pair of traveling conveyors with cutting edges, which travel in the same direction as the machine, and deliver the material removed to a large square covered box, which forms the entire upper part of the machine. This is calculated to hold 5 tons of snow and has a movable floor which is operated by the driver through a special lever, to eject the entire contents at the right side of the machine. This same lever controls a flap at the right side, which normally forms the right side of the snow box.

These levers and the man who operates them, are located at the rear end of the machine, upon a high cross platform, so that the man controlling the dumping into wagons is in a position to watch the wagons from above and control the dumping in a proper and speedy manner. The driver, the only other man needed to operate the machine, is placed in a box-like compartment at the left side of the front end of the machine. He controls the speed of advance, the operations of the engine, and the raising and lowering of the traveling conveyor with the cutting edges. These can be lowered so as to operate within ½ inch of the pavement, so that the machine practically removes all the snow and ice. It can gather up 16 cubic yards of snow per minute, and in so doing compresses this to one-half that volume, or 8 cubic yards. By keeping it adequately supplied with wagons to haul away the snow and ice as fast as it removes the same from the surface of the streets, it can fill 1,300 eight cubic yard trucks daily, based on a 24-hour day with 2 hours out for change of shifts, filling tanks with gasoline, oil, water, etc., and lubricating.

Under certain conditions, when there is more ice, the time needed for loading an eight-yard wagon may be 1½ minutes, but on straight snow, no matter what the depth, the machine has shown that it can perform at the load-per-minute rate given above, in fact the deeper the snow, the more material the machine will remove in a unit of time.

When wagons for loading are not available, or when not enough are available to work it to capacity, it can be made to work in either of two ways; clearing a path and discharging the snow continuously, or depositing the snow in piles of 10 cubic yards each.

When flat cars or similar large receptacles for carting away the snow can be provided, the mchine will remove snow at the rate of 50 cubic yards a minute, or frozen snow and ice at the rate of 10 to 25 cubic yards a minute.

Four speeds are provided, and the machine is so geared as to progress according to the amount of snowfall to be removed, something like this:

In a 6-inch snowfall, at the rate of eight miles per hour
In a 8-inch snowfall, at the rate of seven miles per hour
In a 12-inch snowfall, at the rate of five miles per hour
In a 18-inch snowfall, at the rate of three miles per hour
In a 24-inch snowfall, at the rate of two miles per hour

When not removing snow or ice, as when traveling to and from its work, the machine can reach a maximum speed of 10 m. p. h. It measures 26 ft. in length, by 9 ft. 6 in. width by 12 ft. 6 in. height. Total weight is 22

Fig. 1. Front view of the Friedman snow bank, indicating the character of the material which it will remove

tons. The power plant is a Sterling marine engine of 15 0h.p.. and the drive is through a transmission with four speeds forward and one reverse. Christie four-wheel final drive is used. A novelty which will confuse many in looking at the pictures herewith, is the location of the radiator and power plant at the rear, instead of the more usual frontal position as on motor cars and trucks. Framework is of heavy structural steel, covered with steel plates. The only wood used is in the snow box, and as a covering for the inclined chutes in which the conveyors work.

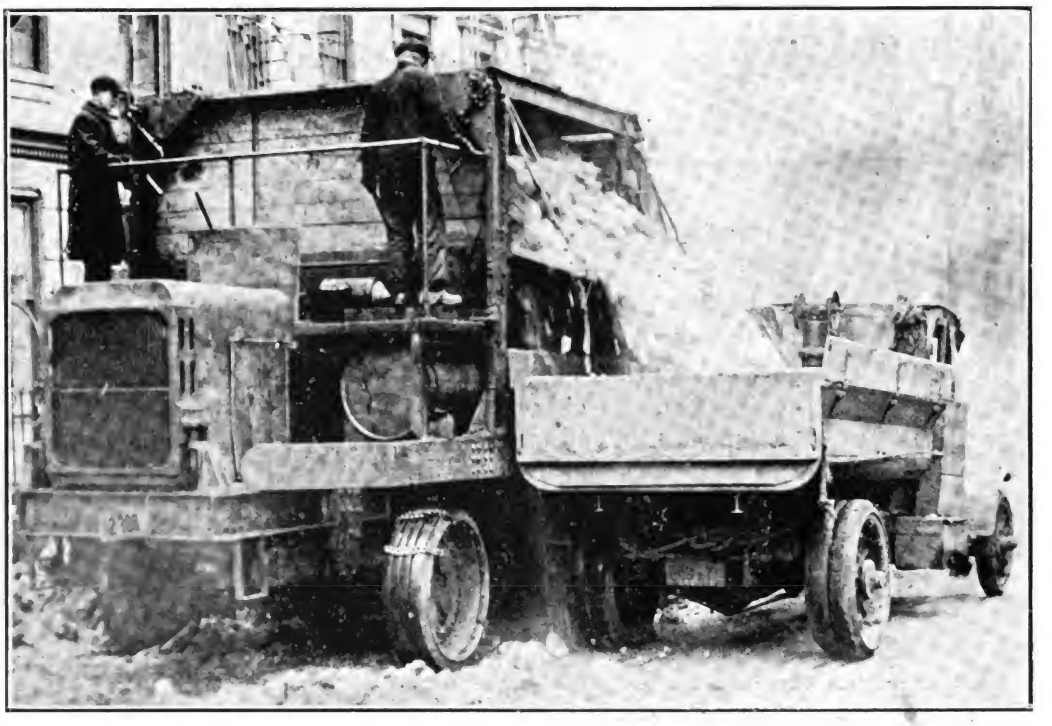


Fig. 2. Rear view of the Friedman snow remover showing the loading of wagons and giving a better idea of the construction.

In a demonstration, made March 19 for Street Cleaning Commissioner McStay, the machine made short work of long piles of broken ice fragments about three feet high, which it scooped up and loaded into trucks faster than the trucks could carry it away, so that a constant stream of trucks and wagons was necessary to keep up with it. In this test, 5-ton trucks were loaded in less than 3 minutes. The data given herewith, based on figures made in a previous test, taken with these results, indicates that the machine actually is going to be a big factor in snow removal in New York next winter, providing Commissioner McStay purchases it. The data is given in the form of a comparison of costs for hand loading and loading by the Friedman tank loader.

COMPARATIVE COST OF LOADING MOTOR TRUCKS WITH EIGHT (8) CUBIC YARDS OF SNOW AND ICE

BY HAND LOADING		BY FRIEDMAN MACHINE LOADING	
8 men, 20 minutes, at 50c, minimum, per hour	$1.33	3 men ($60 per 24 hours) filling truck in one minute	$ .04
		Gas and Oil (5 gals. per hours).	.03
		Wear and tear ($25 per 24 hours.)	.02
		Overhead ($50 per 24 hours.)	.04
Auto truck at $4.00 per hour, waiting 20 minutes while being loaded	$ 1.33	Auto truck, waiting one minute while being loaded	.07
Cost of loading	$ 2.66	Cost of loading	.20
Auto truck carting snow and returning, average 15 min.	$ 1.00	Auto truck carting snow and returning, average 15 minutes	$ 1.00
Cost of loading and carting	$ 3.66	Cost of loading and and carting	$ 1.20
Cost to city, 8 cu. yds at 54c per cubic yard. Plus, expansion 25 per cent (6 yds. on ground expand to 8 yds in the truck.)	$ 4.32 $ 1.08	Minus, compression 50 per cent (16 yards on ground, are compressed. by force of conveyors, to 8 cubic yards)	.60
Actual cost to city of loading and carting 8 cubic yards	$ 5.40	Actual cost of loading and carting eight cubic yards	.60
Piling, 8 cubic yards at 9c per cubic yard	.72	Piling, eight cubic yds.	.04
Total actual cost to city of piling, loading, and carting, 8 cubic yards	$ 6.12	Total actual cost of piling, loading and carting 8 cubic yards	.64

Difference in cost per eight cubic yards ($6.12, less .64)—$5.48 saving.

Allowing two hours daily for rest, filling with gas, oiling, change of shifts, etc., there remain twenty-two working hours daily.

The machine can fill approximately 1,300, eight cubic yard trucks, daily. This means a saving of $7,000.00 daily with one machine.

Speed of machine—2 to 10 miles per hour. Four speeds ahead, and one reverse.

Dimensions,

Length, 26 ft; width, 9 ft. 6 in; height, 12 ft. 6 in; weight. 22 tons; motor, 150 h. p. Sterling Marine; drive, Christie Four Wheel.

Effect of Impurities on Water Requirement of Casein Glue

Experiments at the Forest Products Laboratory indicate that practically all caseins of a reasonable degree of purity can be made into satisfactory glues by the same formula, simply by varying the amount of water used.

Caseins may be divided into definite groups according to the amount of water which they require to make glue of a given consistency. This grouping is roughly the same as the grouping according to methods of casein manufacture. Grain-curd casein requires the least water; lactic-acid casein, ordinary mineral-acid casein, and rennet casein increasingly larger amounts.

The ash contents of these caseins also increases in the same order. In fact, the relation between the ash content and amount of water required is so close that if the former is known the latter may be predicted. The relation between the ash content and the water requirement may be expressed by an equation of the type, wherein the water-casein ratio required to give a glue of medium viscosity is equal to m times the ash content of the casein plus b. m and b being constants.

Automobiles in the province of New Brunswick have increased ten fold in the last six years, totalling 824 in 1913 and 8,000 in 1919.

Control Board for Motor Truck Production

By J. F. DANIELSON**

Press of Orders for Motor Trucks Has Forced Standardization in Many Ways. Lack of It in Others Causes Production Difficulties. Control Board and Tickets Used to Denote Facts in Relation to Progress of Production

BOTH the situation confronting the motor truck producer at this time, and the need for records which will meet the changing conditions of this comparatively new industry, can be set down as attributable in part to:

1. The ever increasing demand for trucks.
2. The tendency to increase the number of models manufactured, made necessary by the varying demands of business.
3. The changes in chassis construction within a model or type due to individual preference of the buyer, and with consideration to the loads to be carried.

It is evident from this that the building of passenger car chassis with its conspicuous standardization methods, where but one or two models are produced, does not present the same problem that truck building with its demands of different lines of business to satisfy.

Of course, the truck manufacturer was quick to realize the value of standardization in parts and methods and this is carried out, as in other industries, to the point where no sacrifice of strength, utility or design is involved.

As a natural sequence of such demands a shortage of materials follows, and with the present labor situation this shortage is accentuated. So any worth-while plan of control must consider the material situation in all of its phases and particularly along the following points:

1. The present status of any unit or part in respect to
   (a) Promised shipments.
   (b) Shipments in transit from purveyors.
   (c) On hand.
   (d) Allotted to present orders.
   (e) Available to future orders.
2. The interchangeability of the unit or part between models.
3. Whether or not further processing is required before being available for final assembly.

The system of planning board presented in this article attempts to show this information and also its relation to the sales and production activities of the plant. Owing to the limitations of the line form of graphs, some plan which would permit of the ready transfer of information from one section of the board to another was necessary and the plan of using small tickets was adopted. The advantages of graphical presentation was not lost and in addition some favorable features of the record system was incorporated in the plan.

The planning board as shown in Fig. 1 is divided into

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**Cost accountant, Diamond T Motor Car Co., Chicago.

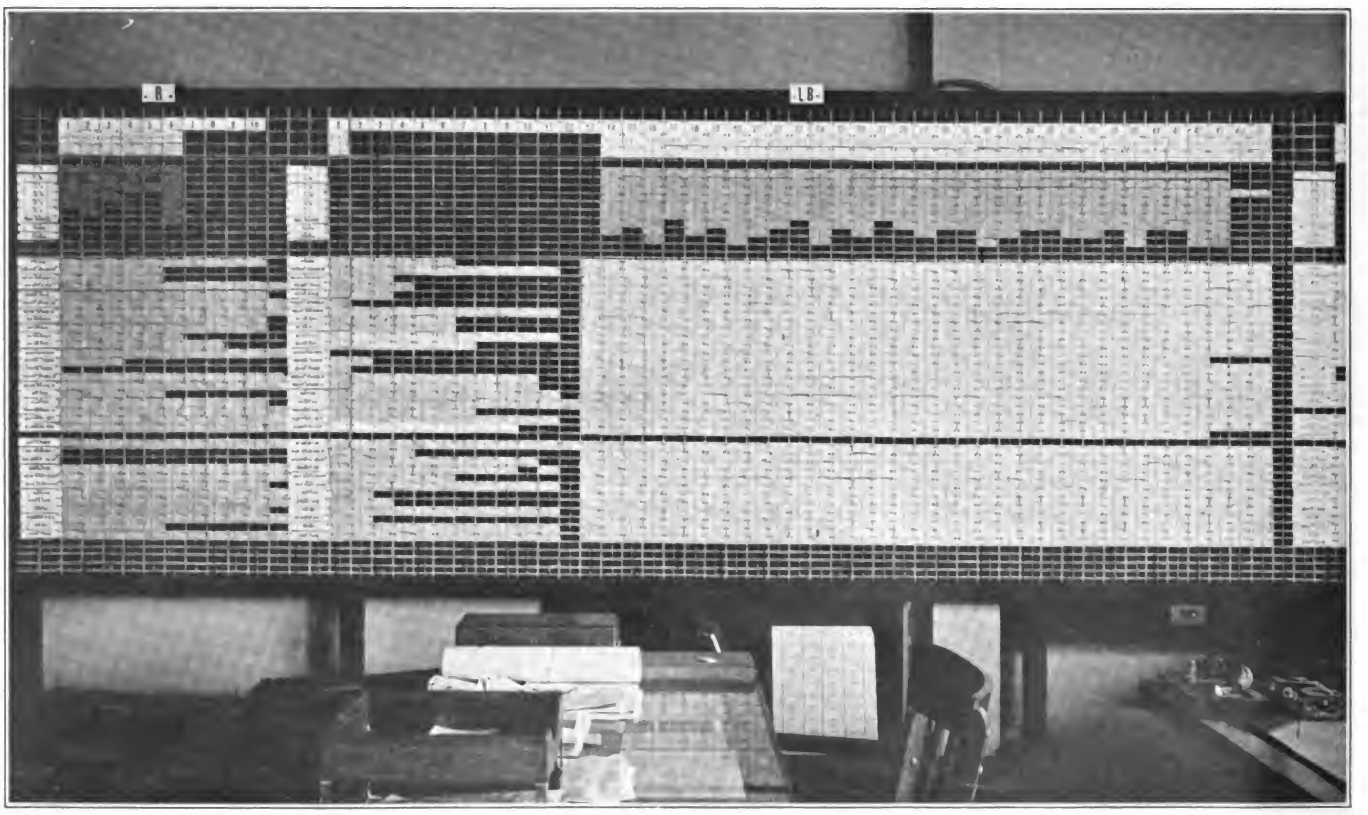
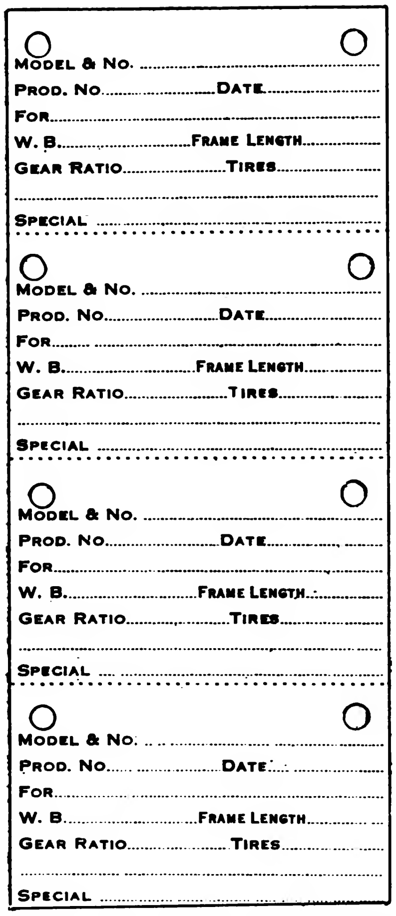


Fig. 1. General Appearance of the Control Board

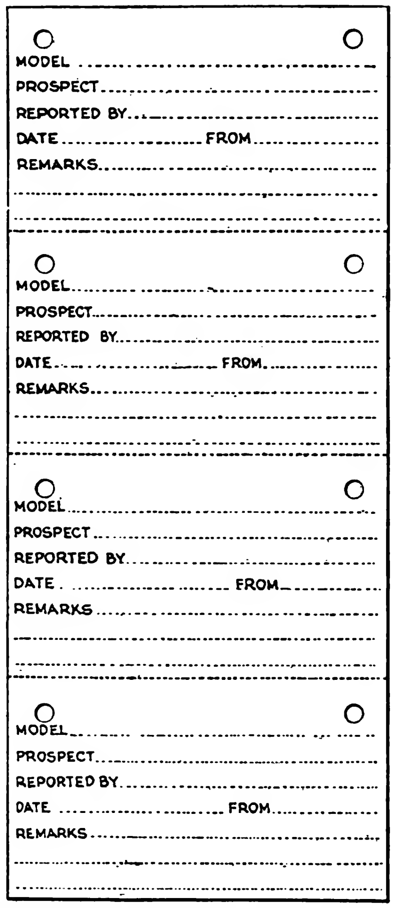

Model & No.
Prod. No. Date
For
W. B. Frame Length
Gear Ratio Tires
Special

Model & No.
Prod. No. Date
For
W. B. Frame Length
Gear Ratio Tires
Special

Model & No.
Prod. No. Date
For
W. B. Frame Length
Gear Ratio Tires
Special

Model & No.
Prod. No. Date
For
W. B. Frame Length
Gear Ratio Tires
Special

Fig. 3. The Order Ticket which is white.


Model
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Remarks

Model
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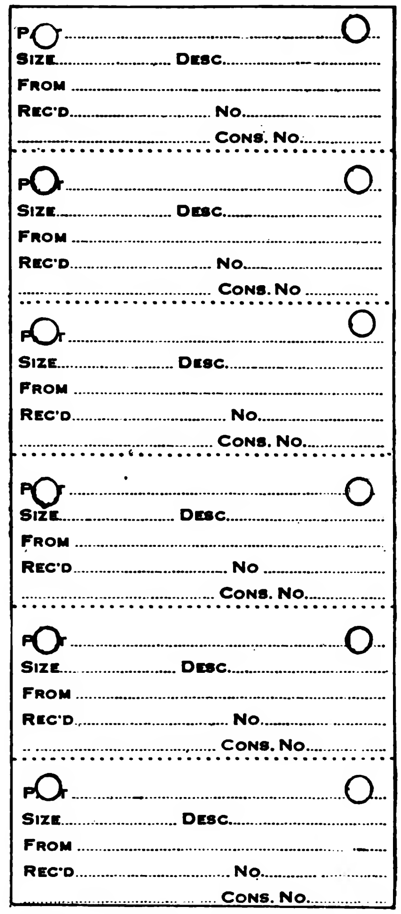
Remarks

Fig. 4. The Production Ticket which is brown.


P.O.
Size Desc.
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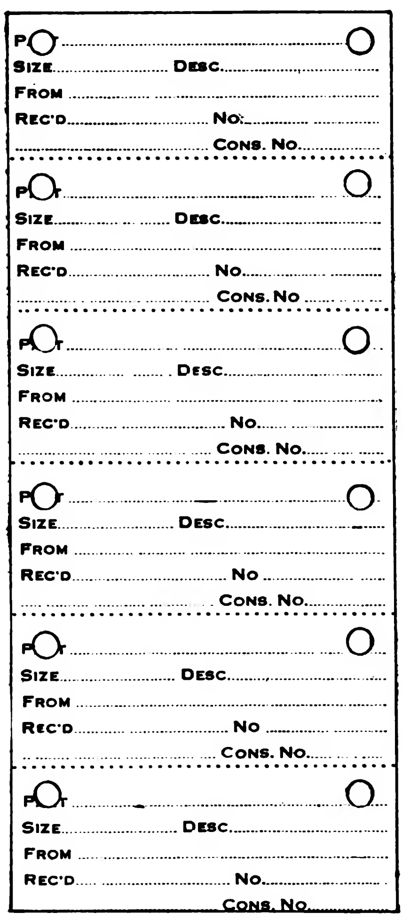
Cons. No.

Fig. 5. Finished Material Ticket, manilla.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Cons. No.

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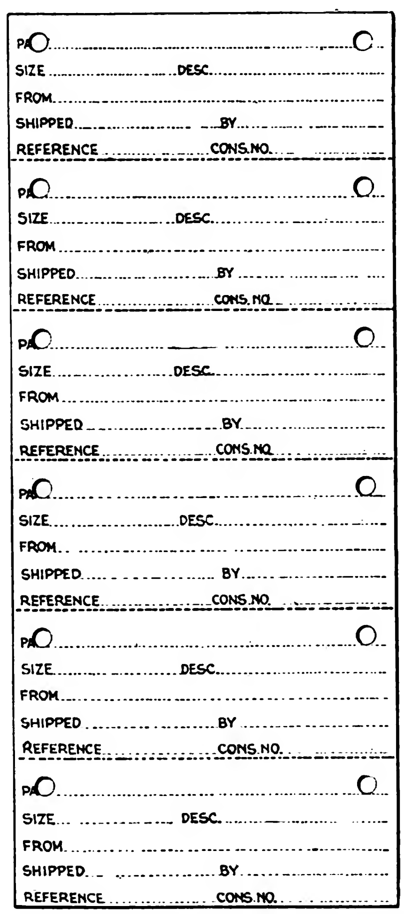
Size Desc.
From
Rec'd No
Cons. No.

P.O.
Size Desc.
From
Rec'd No.
Cons. No.

Fig. 6. Ready for Use Ticket which is blue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Size Desc.
From
Shipped By
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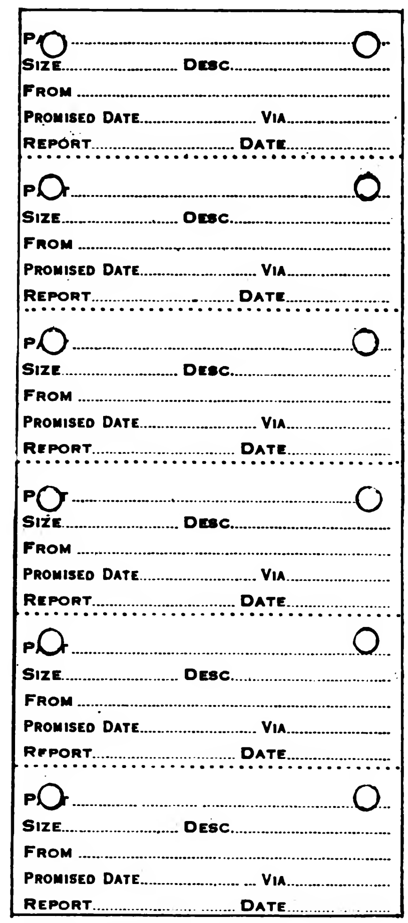
Fig. 7. Shipping Record Ticket which is red.


P.O.
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Report Date

P.O.
Size Desc.
From
Promised Date Via
Report Date

Fig. 8. Promised Delivery Ticket which is green.

as many sections as there are models produced, and the space allotted to each model is dependent upon the production requirements. Any change in space required is readily made by shifting the line headings, which are movable to different positions. The three principal activities shown in each model are:

Sales
Production
Materials.

The operations of the board as they refer to the above divisions will be taken up in the order named:

As Regards Sales

Sales information for the planning board is of two kinds: First, the sales order, copy of which is furnished the planning department, giving complete specifications, date required, etc. This information is placed in an abbreviated form on a white ticket, Figure 3, and placed on the board, Figure 2, at the left hand end of the section of the model called for by the order. Second prospective truck orders, which are reported to the planning department in the nature of a report, giving the information available and by models. In condensed form this information is written on salmon colored tickets and placed at the immediate right of the white tickets representing the actual orders. Prospective order tickets are displaced by the white ticket when order is received, or removed from the board when the prospect is no longer a live one.

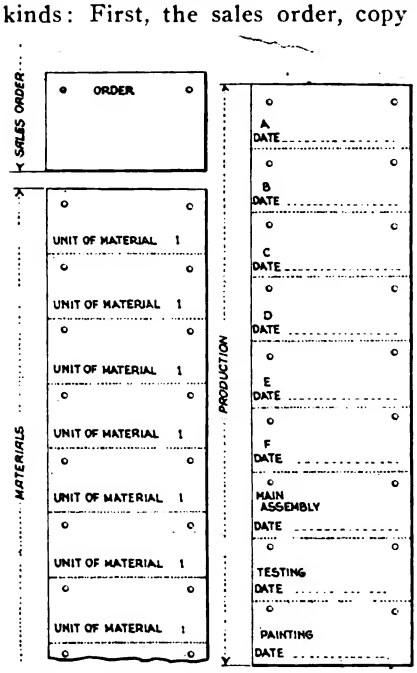

Fig. 2 Method of placing cards in the board. Space limitations have compelled showing the production section at the right; actually it is between the others.

As Regards Production

The planning department issues to the various factory departments, brown colored tickets, Figure 4, marked with the department number, to be dated by the department foreman on completion of the work called for by the instructions which are sent to the factory at the same time. In the various factory departments, these tickets are placed on smaller boards by models, enabling the foreman to see at a glance the work ahead for this department. Tickets are immediately dispatched to the planning department by each factory department on the completion of the work called for. Tickets returned from the factory are placed on the board under their respective truck numbers.

Materials on hand are of two classes: First, that received in a finished state ready for sub-assembly work, and, second, material received on which machine work has to be done, called "rough" stock. The first class is indicated by a manila ticket, Figure 5, the rough stock by a blue ticket. The information contained on these tickets is about the same, giving name of purveyor, date received, receiving report number, description, etc. When "rough stock" has been prepared ready for assembly work as indicated from factory production reports, the blue tickets, Figure 6, are displaced by manila tickets. Each ticket represents the number of units, parts or pieces required for one truck. The situation frequently arises where an impending shortage is seen in the supply of a unit or part, which necessitates keeping in close touch with the facts. It is only in such cases that two advanced steps are taken and shown graphically on the board in respect to materials in transit and promises made for shipments. An invoice, letter or telegram indicating the shipment of such parts, is followed by placing a red ticket, Figure 7, on the board to the right of materials on hand, such ticket bearing information on number of parts or units shipped, how and when shipped, reference to further information, etc. A promise made for shipment to take place at a definite future date is placed on the board by a green ticket, Figure 8, such ticket immediately preceding a manila or red ticket. Any change in the situation, as material promised being shipped the condition is changed as such. It is noticed that as the materials are nearing the sub-assembly stage, they are assuming places which will show the parts as being available for producton carried at the left. Although the tickets are not moved, except in the cases of transfer from model to model, the completed production of trucks which works from left to right, automatically brings the material to this position. Where there is an excess of tickets representing material, which can not be distributed over the available spaces, such tickets are bunched and placed at the last space until more room is provided by completion of the entire order.

While every part entering into the manufacture of a truck is not shown on the planning board, all of the larger and more important items are so placed and those in which there is any difficulty of supply. The board while controlling and arranging for materials to be on hand when required, has also the important effect of preventing an oversupply. This condition is not usually shown up in other forms of records, but, shown graphically, the excess over other units considered on the basis of completed trucks is at once apparent. In addition to the control board a comprehensive stock card system is maintained for the smaller parts, and if the danger arises of a shortage in any of the parts not shown on the planning board, that part can be placed there, until the condition is relieved and has returned to a normal one.

Analyzing the operations of the board as they apply to a single truck under observation, we will notice the flexibility of the plan. The placing of the white ticket, indicative of an order, automatically appropriates the material, if it is available, to complete the truck. If not all available, the exact condition is seen to be acted upon. Further, should the order call for a certain specification in tires and frame lengths, the transfer from unappropriated stock is accomplished by an exchange of tickets. The production division of the board reveals the progress of all trucks in the factory, and will indicate whether the truck produced under a "Rush" order is receiving proper attention.

On the completion of a truck, the sales, production and material tickets are removed from the board, filed, and the space cleared is again available for use, thereby permitting practically unlimited capacity of the board.

Any plan is of little value unless the information it yields will assist in determining the action to be taken by the various departments of the business to further its activities. To sum up in a concise form the results shown by the board in simple graphical form, we can enumerate the following:

For the Production Department

1. Models for which the material is on hand.
2. Arranging for future production.

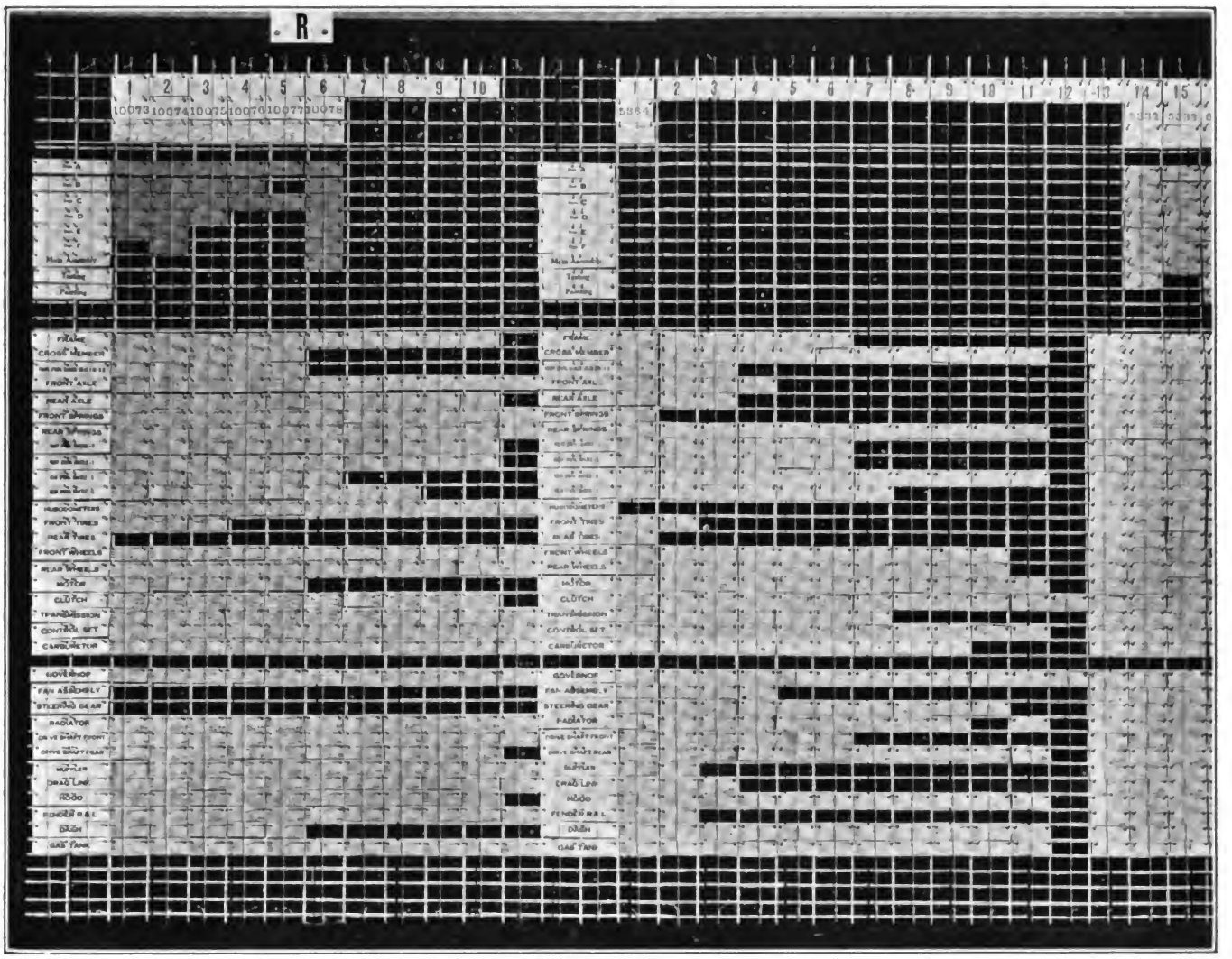

Fig. 9. Close-up view of the control board showing more detail than Fig. 1.

For the Materials Department

1. Shortage and impending shortages.
2. Materials in transit to trace.
3. Surplus stocks.
4. Follow-up on promised shipments.
5. Prospective and actual sales orders ahead to direct the buying policies.

Oil Recovery From Canadian Shales

In its yearbook for 1918, just issued, the Mines Branch of the Department of Mines of the Dominion of Canada reports on the tests on New Brunswick oil shales in the Wallace retort. The shale was taken from Frederick Brook, Alberta mines, and represented a fair average of the seam which is 4½ ft. wide. In the first test, the recovery of oil amounted to 43 U. S. gal. per ton of shale, plus 4,290 cu. ft. of gas. A second test indicated 39.6 gal. oil but no record of the gas was kept because of a leak which developed. A check test on both the methods employed produced 42 and 47 gal. of crude oil, and 3,700 and 3,540 cu. ft. of gas respectively.

The retort is a new device invented and developed by W. G. Wallace, superintendent of the St. Claire Gas Co., E. St. Louis, Ill. The essential idea is to remove the volatile products without subjecting them to a higher temperature than that at which they are liberated from the shale. This is accomplished in a cylindrical distilling chamber which is smaller at the top than the bottom, is surrounded by a circular combustion chamber, and has a cylindrical central perforated gas duct in its center from which the gases are drawn downward and off. This design causes the products of distillation to pass through the cool material away from the heated wall and thus aids in preventing the formation of unsaturated hydrocarbons which are produced at high temperatures. This retort too, is claimed to have a large yield of oil, because the vapors are not subjected to excessive heating which would cause the oil to break up into permanent gases.

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Vol. LXII MAY, 1920 No. 7

The Motor Fuel Situation

IT seems almost impossible to make the average motorist or truck owner realize the exact situation with regard to supplies of motor fuel, in fact, it is only within the last few months that the car manufacturers have been convinced of its gravity.

It can be summed up in this way, there is an actual shortage of crude oil today, the amount consumed exceeding the amount produced, so that a supply is made available only by drawing upon Mexico and our storage resources.

The January production total was 33,980,000 bbls. and the amount consumed 34,683,000 bbls., a shortage which was made up from Mexican imports and our own storage resources, of 703,000 bbls. or in gallons, of 29,526,000 gals. Where this is going to end with car and truck production proceeding at a rate of more than 200,000 vehicles a month, which in turn adds 80,000,000 gals. per year to the consumption of motor fuel, and that rendered in terms of crude oil is adding, roughly, 10,000,000 bbls. a year to the amount needed, no one can say. Not even the wisest can foresee where this situation will end, but everyone connected with the automotive industry should resolve to do his utmost to economize on fuel throughout the year, some in actual use and consumption of it, others in the production and promotion of devices for making less of it go further, and others in other ways.

Good Roads in the Broadest Sense

MANY persons seem to have the idea that farmers and automobilists are the only ones benefiting from good roads. As the country is entering upon an era of road building, and most of this is to be permanent, and consequently, expensive construction, it is important that this narrow view of the situation be corrected.

Thus in the broadest sense, good roads benefit everyone, and not the least of the immediate results will be a reduction in the cost of necessities. It is said by Government experts that farmers lose $300,000,000 a year in marketing their crops because of bad roads. They do not actually lose it, but add this amount to the products they actually market, so everyone helps to pay this penalty for bad roads.

The problem of to-day is to reduce the cost of getting the products of the farm to the table of the producer, and there is no factor in this so potent as the good road surface, which taken in conjunction with the automobile and motor truck, permits speed that saves much foodstuff, produces certainty which avoids letting the crops rot, gives timeliness which saves more, reduces the cost and delays of railroad transportation, and contributes in other ways. So, good roads in the broadest sense interest all of us through our pocketbooks.

The Need For Greater Production

WITH little or no regard for the actual saturation point in production of motor cars and trucks, for all that is speculation—no one knows and no one can know, what the actual saturation point is, the fact remains that the world is calling as it never did before for cars. It is estimated that this country alone could absorb twice as many cars as can be produced. Under such circumstances, all cars sell and sell quickly, and the cry for greater and greater production continues.

In bringing about great production, it is not possible simply to put in more machinery, employ more help, and buy more raw material. This is impossible today because delivery of machines and materials can not be had, while there is no such thing as hiring more help—it is not available. Under such circumstances, the manufacturer must increase production with such facilities as he has, such men as he has, and manage the best possible way with regard to increases of raw materials and parts.

With the thought foremost in mind of helping the manufacturers, in this their dilemma, the articles on production in this issue have been presented. One of these goes into details as to the methods employed in the Ford factory; this was started in the April issue and is concluded this time. The other refers to a more or less ideal method of factory routing, and following the routing through, which we assume is in force in the Diamond T motor truck factory, inasmuch as the author is employed there. These two articles take up production from two different slants; the one shows what is actually being done in the shop by means of super-refined machinery and equipment; the other presents way of saving time and labor by means of the classification and handling of information, a more or less office proposition. The value of both is self-evident

Three international exhibitions of automobiles and accessories, or rather, three parts of the same exhibition, will be held at Antwerp, Belgium, in connection with the international Olympic games. The first is from May 15 to June 13 for cars, tires, wheels and separate parts; the second, June 26 to July 25, for trucks and tractors; the third from August 7 to September 15 for motorcycles, bicycles and their accessories.

American Claudel Carburetor Embodies Diffusor and Jets

NECESSITY for more stingy motor cars, or more particularly, more economical carburetors, is going to be forced by the fuel situation very shortly. At this critical time, when everyone is talking of greater economy, but no one making much progress toward it, the announcement of the Claudel Carburetor Company is timely. This concern is now manufacturing in its Long Island City, N. Y., plant the Claudel carburetor so widely used in Europe during the last 20 years. This device is of the

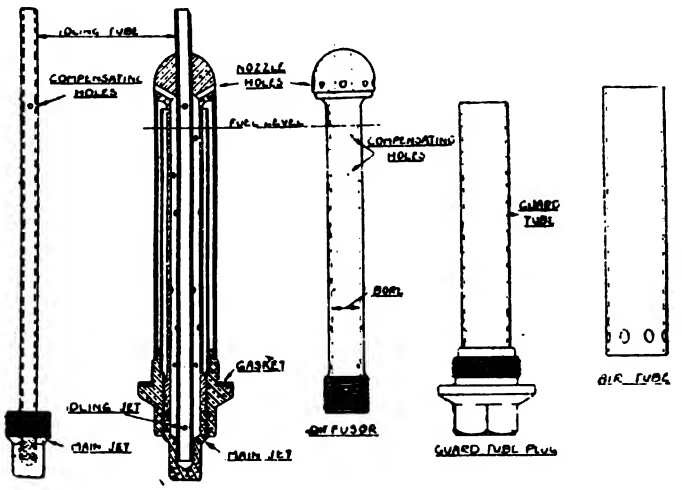


Fig. 1. Diffusor, the principal part of the Claudel carburetor, in section, and its principal components.

plain-tube type, its inventor Charles Henri Claudel, being considered the pioneer in the developmnt of the plain-tube form.

Records made by Claudel carburetors in European racing before the war were both numerous and comprehensive, ninety-three first prizes being captured in 1913, in addition to the Indianapolis race and the breaking of all world's records on the Brooklands track in England. They were employed extensively on the foremost Allied aviation engines from the beginning of the war in 1914 until the end. Among these were the Rolls-Royce, Sunbeam, Peugeot, Salmson, Hispano-Suiza and Renault.

They made the first round trip across the Atlantic from England to America on the Sunbeam engines of the British dirigible R-34. They were also used on the Rolls-Royce engines of the Vickers-Vimy airplane which was the first plane to make a non-stop flight across the Atlantic. The fact that this craft completed its long flight with one-third of its fuel unused is a striking commentary on the fuel-saving ability of the Claudel.

Another Claudel performance was the world's new speed record of 232 miles per hour established by Sadi Lecointe, the famous French aviator.

Amercanized in Design

The engineers of the Claudel company have Americanized the European model to meet the particular requirements of engineering needs in this country. They have added several features demanded by the American motorist, such as a quick starting device and rapid acceleration with a cold engine.

Early carbureting devices employed a spring-controlled air valve in an effort to secure the proper mixture balance throughout a wide range of engine speeds. In 1903 Charles Henri Claudel, of Paris, France, patented the first plain tube automatic compensating carburetor without the use of moving parts. His early principle of breaking up the gasoline by a swift current of air, making an emulsion inside the jet itself before delivery to the carburetor proper was original and has been widely copied. The modern device retains this principle, refined and improved to vaporize the heavy fuel of today.

The Principle of Action

The automatic functioning of the carburetor is based upon the action of the diffuser jet assembly. This device combines three distinct principles of operation:

First—The orifice or jet which supplies all of the liquid fuel is placed at charge, or below the fuel level, where its flow is proportional to the difference in head.

Second—The diffusor proper is in "shunt" position, that is, enclosed in a chamber with openings at one end to the atmosphere and at the other end to the suction in the carburetor, thereby reducing the effect of the suction on the fuel flow.

Third—Through the nozzle holes in the diffusor head the interior emulsion chamber of the diffusor is placed under the direct action of the vacuum in the carburetor, increasing the discharge as the vacuum is increased.

The combination of these three principles of operation, correctly applied, gives a balanced mixture exactly proportioned for the best results at every engine speed and load.

The device is really a combination of two types of jet,

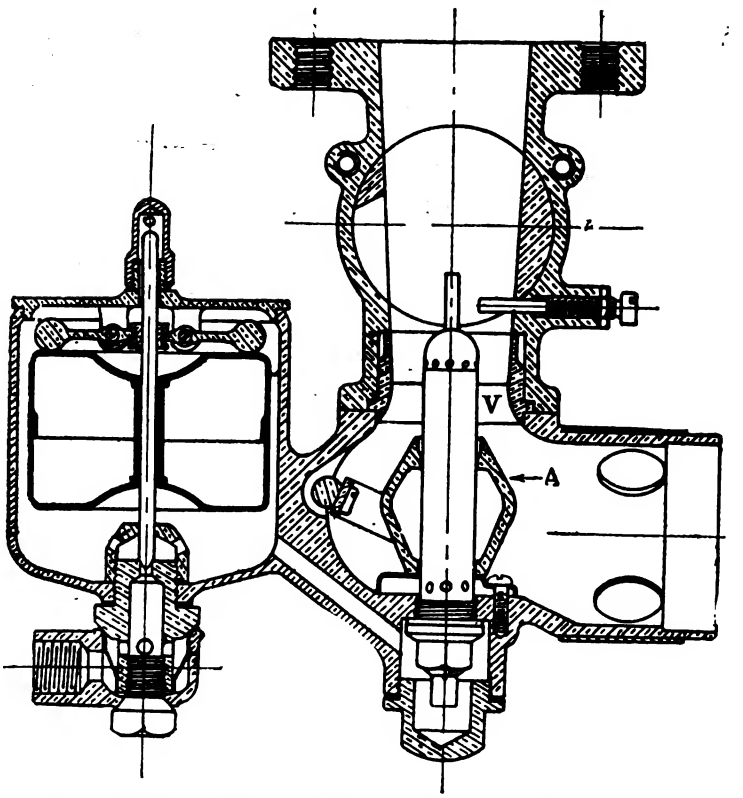


Fig. 2. Section through the standard American design of Claudel carburetor.

one, the main jet, Fig. 1, of constant flow per unit of time; the other, shown as a series of nozzle holes, of suction-controlled flow. Fig. 1 indicates the fuel level when the carburetor is at rest. Fuel from the float chamber flows through the main jet into the diffusor, then through the compensating holes into the reservoir or diffusor bore. It also flows through the idling jet into the idling tube, the level in the three tubes being the same as that in the float chamber.

The Diffusor

Air at atmospheric pressure enters the outside base or air tube of the diffusor column, passes up this outer sleeve and over the top of the gasoline guard tube, which prevents the fuel from overflowing. As the throttle is opened gradually and the suction in the diffusor increases, thereby lowering the liquid level in the diffusor bore, a series of air bleed or compensating holes are progressively uncovered. Through these holes the air rushes into the ascending column of gas vapor and out the nozzle holes at the top of the diffusor in a finely broken-up gasoline emulsion. The higher the suction acting upon the diffusor, the lower will be the level of gasoline within it,

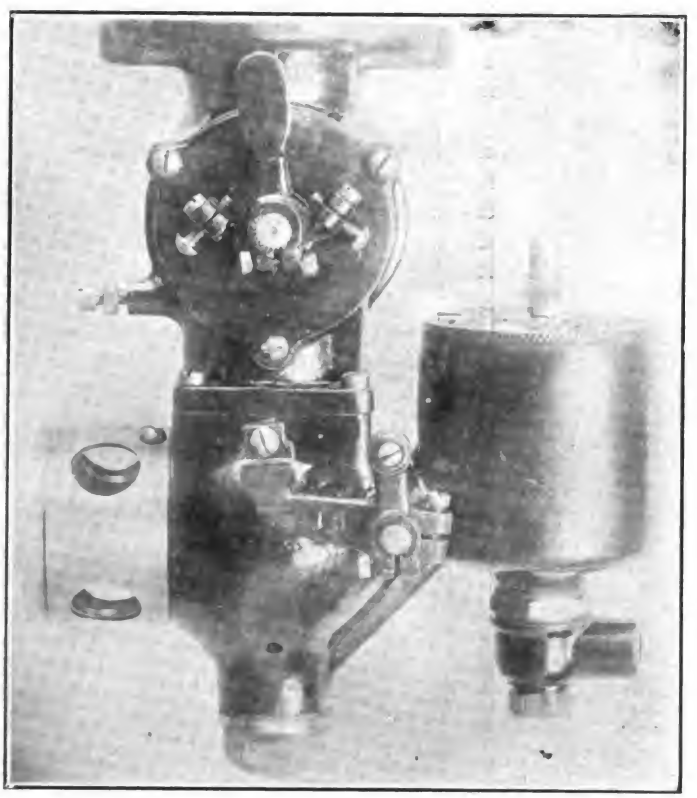


Fig. 3. General exterior view of Claudel. This is highly finished with a dark red enamel and polished brass fittings.

and therefore, more of the compensating holes will be uncovered, permitting a greater dilution of the mixture.

At the higher speeds the diffusor is practically emptied and twenty-one spirally-arranged air bleed holes are in action. As the gasoline globules are lifted by the suction, they must pass through this barrage of twenty-one air guns shooting at right angles into the ascending fuel. This turbulent mixing effect produces a finely divided fuel emulsion ideal for rapid flame propagation, extreme economy and high power. The diffusor discharge is in approximately the ratio of fifteen parts of air to one part of gasoline by volume. This thorough intermixture of air and gasoline before it enters the carburetor barrel is the Claudel method of breaking up the heavy fuel of today for extreme economy.

It will be seen that any kind of a power or consumption curve desired can be secured by changing the size and position of the compensating holes in the diffusor wall. For example, if the consumption curve shows a rich spot at an engine of 1000 r. p. m., the holes at this level of the gasoline in the diffusor could be enlarged, thinning out the mixture and bringing it to the point desired. In this way, an exact gasoline and air ratio can be maintained for the best results.

The clean, streamline interior of the plain-tube carburetor with the barrel throttle giving an extended venturi effect, leaves no obstruction in the path of the charge and consequently full volumetric efficiency is secured. Also the gradual taper of the interior walls holds the mixture in uniform suspension and velocity.

The Idling Device

The idling device is incorporated in a central tube projecting up into the depression of the barrel throttle, where a strong pull is exerted on the idling jet for low-speed action. The barrel throttle is slotted to pass around the idling jet end the only adjustment on the carburetor is a screw extending into the air space to partially block off the area of this slot as desired. Screwing it in lessens the air area and enriches the idling mixture. Screwing it out makes the mixture leaner.

Easy Starting Feature

In the American type shown in Fig. 2, a decided improvement has been incorporated for strangling the air by means of a sliding air cone, controlled from the dash. This device assures quick starting and warming up in cold weather, and disregards temperature. The streamline air cone, concentric with the diffusor, may be raised into contact with the venturi, shutting off the air supply and putting the full suction on the diffuser. In this position it is only necessary for the cylinders to exhaust the air in the top of the carburetor before the diffusor discharge must commence. This action is instantaneous, as the volume is small.

Referring again to Fig. 2, the sliding cone A, in its closed or strangling position, fits snugly into the venturi entry V. The streamline shape of the cone centers and steadies the air stream so that it passes the nozzle holes of the diffusor with high velocity and in an even column ideal for the best results. In its lowest position the cone offers no restriction to the maximum performance required and is of benefit in minimizing air intake turbulence.

In warming up a cold engine when a richer mixture is necessary, the cone A may be dropped slightly, forming a variable venturi. With the cone in this restricting position one may readily get away while his engine is still cold. Thus, in reality, it acts as a double carburetor—one of small venturi for normal driving, and, with lowered cone, another of full engine capacity.

The advantage of the cone over the common type of butterfly strangler valve, placed some three or more inches ahead of the fuel discharge nozzle, is very evident. In the latter type, all of the dead air lying between the nozzle and the strangler valve must be exhausted before

fuel will begin to flow. In the Claudel type, suction on the nozzle is instantaneous.

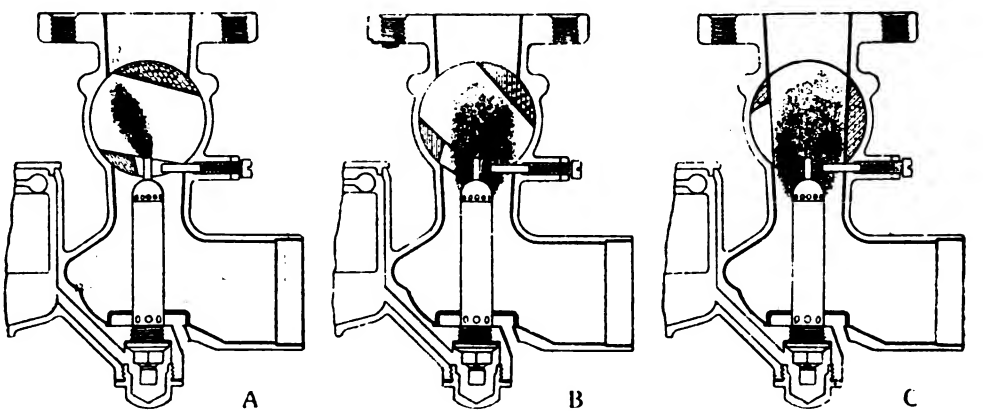
When the common butterfly strangler is only slightly open (condition when warming up), the small amount of air passing the fuel discharge nozzle has little or no velocity and hence can pick up very little fuel. Fuel, however, is discharged because of the greater pressure existing in the float chamber than in the mixing chamber, and instead of being picked up by the air, this raw fuel runs down to the butterfly strangler, where the air velocity is highest, there to be partially vaporized and carried into the engine. In the Claudel type, on the other hand, an emulsion is discharged from the diffusor nozzle where it is immediately carried upward by the air entering at high velocity through the small, annular, streamline passage between the cone and the venturi.

On the airplane carburetor the air cone, in much the same design, is used as an altitude corrector. Due to the lesser density of the air at high altitudes and the consequent lessened oxygen content of a given volume, it is not necessary to supply the same amount of gasoline for ground elvel. When the plane sequent lessened oxygen content of a given volume, it is noe necessary to supply the same amount of gasoline for complete combustion as at ground level. Hence the flow of gasolien must be checked to secure the desired economy.

In the airplane device a venturi is installed several sizes in excess of the capacity required at ground level. The streamline cone is then raised and adjusted in the position of performance at reaches an altitude of several thousand feet the pilot lowers the cone progressively as his plane ascends, enlarging the venturi, decreasing the suction on the diffusor and retarding its delivery. Full power is thus obtained without waste of fuel. This corrector was used with great success the war, and subsequently.

The Claudel is a very high grade carbureting instrument built in a number of standard S. A. E. vertical sizes. A horizontal model will be announced later. Special models however, for special installations are built to order, including airplane and duplex designs.

The carburetor is highly finished and carefully built for quality performance and appearance, and is universal with regard to levers and flange positions.



Progressive action of Claudel device. At A, with barrel throttle in idling position. At B, half throttle opening with diffusor jets in action. At C, wide open throttle, diffusor jets operating to full capacity.

Forest Products Laboratory Decennial Celebration

Forest Products Laboratory was organized by the U. S. Forest Service in 1909 and formally opened in June, 1910. It is conducted in co-operation with the University of Wisconsin.

During the ten years of its existence the efforts of the laboratory have been devoted to the development of improved methods and processes for the better utilization of forest products of all kinds, and to the direct assistance of the industries concerned. Among the major lines of endeavor are the following:

Pulp and paper	Laminated construction
Hardwood and softwood distillation	Chemistry of wood
	Boxing, crating, packing
Preservation of wood .	Needle and leaf oils
Decay and decay prevention	Ethyl alcohol from wood waste
Mechanical properties of wood	Wood finishes
	Aircraft parts
Glues for wood	Veneers and plywood
Kiln drying and air seasoning	Steam Bending
	Identification of wood
Grading structural timbers	Microscopy of wood
Grading lumber	

During the war direct assistance was rendered the War and Navy departments and various other branches of the government in the solution of many important problems, particularly connection with aircraft, gun stocks, artillery wheels, escort wagons, and the boxing and crating of arms and stores for overseas shipment. It was necessary, throughout this period, to abandon all work on the regular peacetime program.

A good many men acquainted with the work of the laboratory have expressed the thought that the laboratory and the service rendered by it should receive some mark of recognition or appreciation from the industries which it serves. In response to this thought, the decennial celebration has been planned, and the General Committee organized to carry out the detailed arrangements.

The present plans call for a two-day program, on July 22 and 23 ,including addresses by men prominent in science, industry and commerce; inspection of the laboratory; a banquet; and various other forms of instruction and entertainment. It is proposed to make a permanent record of the decennial in the form of a souvenir publication to contain all of the addresses and other relevant matter, including the names of those who can permit a permanent record of their cooperative contributions to be made.

It appears now that a shortage of cotton may induce higher tire prices. Tire men estimate that the 1920 needs call for 80,000,000 casings, or on the basis of 8,000,000 cars in use and 2,000,000 new cars to be produced, eight tires per car.

Splendid Performance of a Pioneer Motorship

By Charles W. Geiger

AFTER an absence of more than four years the East Asiatic motorship Siam, the pioneer craft of her class to be sent to the port of San Francisco, recently arrived from Copenhagen, resuming the service that was interrupted when the world war broke forth. The Siam is a 10,000-ton vessel. Her main engines are eight-cylinder sets of 1575 indicated h. p. each.

The Siam, which was commanded by Captain E. Kimmalestrop, made the passage from Denmark in thirty-four days and came up from Balboa in thirteen days. The engines, it is reported, have never given any trouble, with a few minor exceptions, from the time the ship went into commission, and the officers believe that in five years she will bear the same reputation.

The Siam is one of the most interesting motorships afloat—as far as the local shippers are concerned—for she was the first of the type to successfuly demonstrate the possibilities of internal combustion engines. The East Asiatic Company was the first concern in the world to announce it had discarded the steamship in favor of the motor ship.

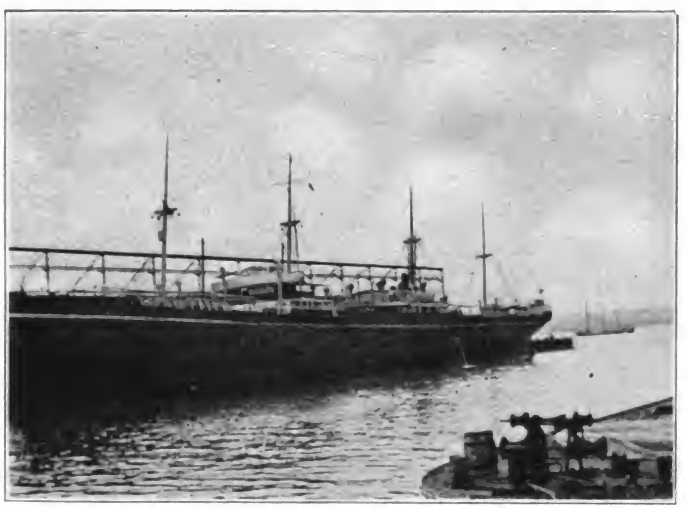


Fig. 1. Motorship Siam passing through the Panama Canal.

The Siam arrived at San Francisco for the first time in January, 1914, after a voyage of about 15,000 miles. The consumption of fuel for the trip was 0.35 pounds per brake h. p.

At San Francisco she took aboard about 6,500 barrels of fuel oil of 24 degrees Baume gravity. She has a carrying capacity of fuel of about 8,500 barrels. Twenty-four degree Baume gravity is especially produced by the Standard Oil Company after due consideration had been given to the principles of an oil for these engines. The arrival of the Siam has stimulated a special interest in Diesel engine propulsion on this coast where an abundance of suitable oil for Diesel engines is available.

Not long before the recent arrival of the Siam at San Francisco the Swedish motorship Lima left San Francisco with a cargo of California products for Gothenbug under the direction of W. R. Grace. At about the same time motorship George Washington of the Norway-Pacific Line arrived in San Francisco for a cargo of California products for the Scandinavian countries.

One of the passengers on the George Washington was Fred Olson of Christiania, one of the wealthiest ship builders of Norway. Aside from being a shipbuilder, Olson is president of the Norway-Pacific line. As part of the world-wide expansion of Norwegian shipping interests the Norway Pacific since 1917 has been bringing into San Francisco a number of cargo-carrying motorships plying between all ports of consequence on this coast.

The thought of plying an independent Norwegian service directly between Scandinavian, chiefly Norwegian,

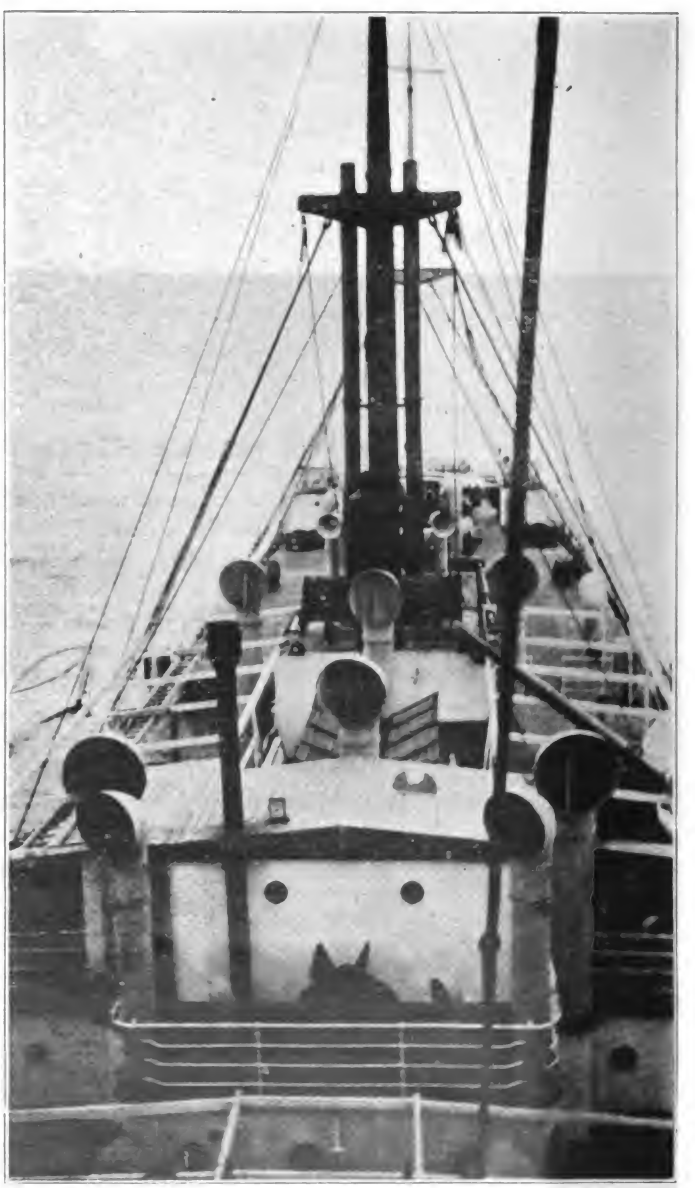


Fig. 2. View of deck of Siam showing two exhaust pipes beside mast

*Editor, Oil News, Chicago, which has kindly loaned the illustrations.

ports and those on the Pacific coast via the Panama canal was inaugurated by Olson. Prior to the close of the canal the steamer Bravo twice carried valuable cargoes both ways from San Francisco. When the close of the canal suspended operations a new start became necessary, and the motorships Brazil and Bayard, 4,250 and 5,300 tons respectively, and modernly equipped with Diesel engines, twin screws, wireless, etc., were put into service. They were followed by the George Washington of 10,000 tons, which in 1917 made its maiden trip. Many new motorships have been added to the service since that time.

The demand for Diesel oil for motor vessels has been increased to such an extent (due to the recent resumption of the various Scandinavian motorship lines, and the growing popularity of internal-combination marine engines), that the W. R. Grace Company maintains an oil tank at Balboa that has a capacity of 25,000 barrels, where there is maintained a continual supply of Dieset oil for motor vessels.

The facilities for handling fuel oil at the Canal Zone are of the best, as the Panama Canal pumps at the Government oil cribs at Balboa and Cristobal are at the disposal of all vessels, thereby enabling them to bunker with a minimum detention.

Oil Electric Propelled Yacht "Elfay"

The yacht Elfay—the first in the world to be driven by the Diesel electric system of propulsion—left by New London January 15th for Cuba, Bermuda, and other Southern ports.

This most interesting little vessel, shown in Fig. 1, which was originally the "Katoura," was built by Herreshoff for Robert E. Tod in 1914. She is essentially a sailing schooner, 125 ft. over all, 30 ft. beam, and 313 tons gross; but her present owner Russell A. Alger, Jr., who bought her in 1916 and changed her name to Elfay, desiring to install auxiliary propelling apparatus, decided on the most modern variety. Her propelling euipment consists of a 6-cylinder 115 H. P. model 54 Winton Diesel oil engine shown in Fig. 2, direct-connected to a 75 k. w. Westinghouse generator. This supplies power to a 90 h. p. Westinghouse motor of 360 r. p. m. which is directly connected to propeller, as can be seen in Fig. 3.

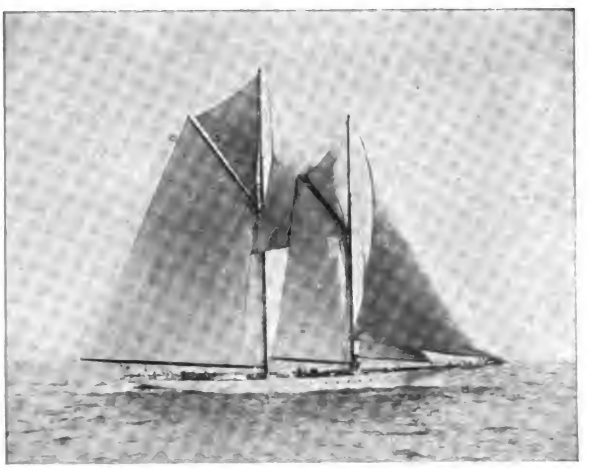


Fig 1. The yacht Elfay, which is Diesel engined, under sail

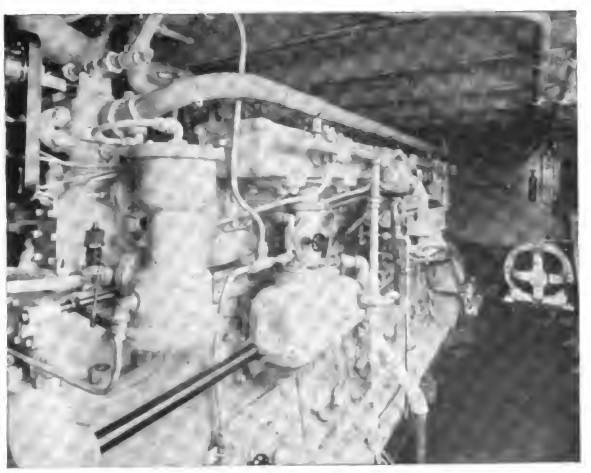


Fig. 2. Winton Diesel engine of the Elfay, drives generators

The control of this motor is centered in a single handle located on the deck. By turning this handle in one direction, the propeller motor is started from rest and brought through several steps up to full speed ahead. By turning the control handle in the reverse direction, the motor is reversed in a similar manner, and the change from full speed ahead to full speed astern can be effected in 5 seconds. There are no signals to the engine room and the officer in charge has full control of the propelling equipment. A set of meters gives the navigator full information as to the performance of the machinery.

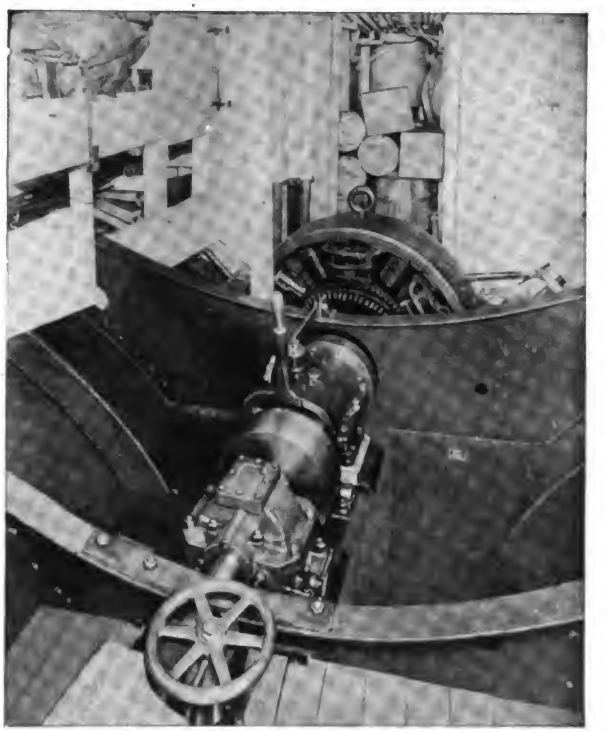


Fig. 3. Electric motor direct—connected to propellor through clutch

This simplicity of control is due to the fact that the

controller handles neither the main engine nor the main motor current, but only the small generator-field current. The engine itself is run at a constant speed, a very economical arrangement.

All of the auxiliary equipment of the Elfay is electrically operated, including the winches, pumps, fans, blowers, ice machinery, etc. She is also electrically heated, but cooking is done by an oil range supplied with electrically-pumped oil.

The Elfay will depend mainly on her sails but she has a cruising radius of 2,000 miles on her motor drive, since she can carry 2,400 gallons of fuel oil and consumes 7½ gallons per hour. Her speed at the full power of the motor is 8½ knots.

Waterproof Finishes For Aircraft

By LIEUT. H. A. GARDNER, U. S. N. R. F.

Some comprehensive tests have been made by the Forest Service to determine the resistance to moisture of various kinds of finishes for wood. The results of these tests might be applied to the finishing of propeller blades or special wood parts, where high moisture resistance is desired. In these tests, panels which were finished in various ways were exposed to an atmosphere saturated with moisture. Weighings were made at different periods to determine the gain in weight by absorption.

Some of the preliminary work included the use of a phenol condensation resin which showed great resistance to moisture. This material however, has been found rather difficult to apply, as it is necessary to have the wood very dry during the process of impregnation. Paraffin and beeswax impregnations followed by varnishing were found not to afford the desired protection. Moreover, it is difficult to secure adhesion of varnish over such materials. Coating with metals by the spraying process was not successful and it is probable that the sprayed coatings would be torn from the surface of propeller blades by centrifugal force.

Many type of varnishes were tried. Excellent results followed the use of a thin metallic coating such as aluminum leaf or imitation gold leaf. For this purpose, the wood is first filled, varnished, and coated with gold size liquid. The aluminum leaf is then applied. After drying the surface is varnished over with a highly waterproof varnish. The use of this process would add very little to the cost of finishing. Aluminum leaf is recommended in preference to other metal leaf on account of its toughness. Some of the results expressed in approximate units of water absorbed by panels treated in various manners are shown below:

Absorption of units of water at end of 17 days in moisture cabinet.

Aluminum leaf treatment (as above)	5
One coat filler, 3 coats varnish	86
5 applications of hot linseed oil, 2 coats wax	569
No treatment	619

Tests were also made with panels electro-plated with copper. Very good results were obtained from a moisture protection standpoint; the absorption in units of water as expressed above being approximately 5. This coating, however, has the disadvantages of being low in strength, not adhering properly, and adding considerably to the weight of the wood. Experiments were made also with samples of wood coated with hard rubber (about ⅛ inch thick) which was probably vulcanized after application. The moisture absorption was low, and, as expressed in the above experiments, was 6 units.

Tests have been made which show that wood coated with high grade spar varnish absorbs but comparatively small amounts of water in a specified period. Four coats give a much higher resistance than three coats. The same grade of varnish mixed with pigment (enamel) is even more resistant than the clear varnish. This indicates the advisability of using enamel paints rather than varnish on floats, pontoons, and hull construction, in order to prevent increase in weight of such construction by absorption of water.

Shrinkage of Veneer From Boiled and Steamed Logs

According to present practice, logs which are to be cut into veneer are either steamed or soaked in hot or boiling water for several hours to soften the wood. The claim is sometimes made that the veneer from boiled logs is likely to shrink and swell less with changing moisture content than the veneer from steamed logs. This point was made the subject of investigation by the Forest Products Laboratory at a plant using both methods of preparing the logs.

Thirty sheets of 1-12 inch rotary-cut birch veneer, 60 inches square, were selected from about six logs prepared in each way. The sheets were carefully measured, passed through a textile dryer, and measured again.

The average moisture content of the boiled veneer and that of the steamed before drying were practically the same, being 64.8 and 65.5 per cent, respectively. The average moisture content for both kinds after passing through the drier was 10 per cent, and the moisture contents of all dried sheets were between 7 and 13 per cent.

The shrinkage caused by drying was found to be the same for both kinds of veneer. When the dried sheets were resoaked, they expanded to their original dimensions, and when subjected to a second drying shrank as uniformly as before.

Although these tests were very crude, they indicate that the shrinkage of veneer from boiled and steamed logs is practically the same. The variation is no greater than is found between pieces from different logs which have undergone the same treatment.

Synthetic Fuel Oils From Lignite in Germany

According to Bergbau (Mining) transmitted by the Bureau of Foreign and Domestic Commerce, war time experiments in Germany showed that the distillation of lignite at a high temperature gave a liquid coal tar which contained certain ingredients suitable as a substitute for gasoline, kerosense and lubricating oils.

Through a new process benzine and kerosene can be obtained from liquid coal tar, which has been distilled from lignite at a lower temperature, and all industries using lignite are urged to set up facilities for generating this liquid coal tar and thus secure synthetic products to supply the lack of the natural products.

It is interesting to remark that, at this time when there is a shortage of fats in central Europe, German newspapers are advertising a liquid tar soap containing a percentage of alcohol for shaving purposes. This is undoubtedly a by-product.

Machining Two Hundred Cylinder Blocks an Hour

By FRED H. COLVIN*

Unusual Methods and Special Machinery Necessary to Produce the Tremendous Output of Ford Cars Exceeding 3,400 per 16-Hour Day

(Continued from page 29, April issue.)

THE ends of the main bearings are finished with straddle mills, after which the transmission end of the crankcase is turned true with the bearings so that the clutch and transmission members will be exactly in line with the crankshaft. In order to insure the ends being perfecly square, two cylinder blocks are clamped on a mandrel which runs through the bearings, and both castings are driven between the lathe centers from the faceplate as shown in Fig. 15. Figs 10 to 15 indicate operations and the tools and fixtures with which they are made, as referred to in previous issue, notably on page 29.

This method (Fig. 15) enables two crankcases to be turned at the same time, the turned surfaces being shown at A, this being a finishet cylinder block. The arm B and the pad G are simply for convenience in putting the work into the lathe, the turning operation being extremely simple, as can be seen. A special loading fixture is providing, and the toolpost carries four tools in a turret. These conveniences enable an operator to handle 22 cylinder blocks per hour per machine.

The camshaft holes are bored and reamed in the double-headed machine shown in Fig. 16. The cylinder block is located by the bearing bolt holes previously referred to, and clamped in position by the ingenious combination of bell crank and cam shown at A and B. The design is very similar to that used in the Ford transmission and is very effective. Eighteen of these machines are required, the capacity of each being 15 per hour. The simplicity of the fixture and the machine makes the method easily adaptable on smaller production.

The holes for anchoring the babbitt in the bearings are then drilled radially in the main bearing, after

*Principal Associate Editor, American Machinist. This article is published through special arrangements with Mr. Colvin and the American Machinist.

Fig. 10. Milling both ends of cylinder block, ten at a time.

Fig. 11. Finish boring the cylinder block with reamers.

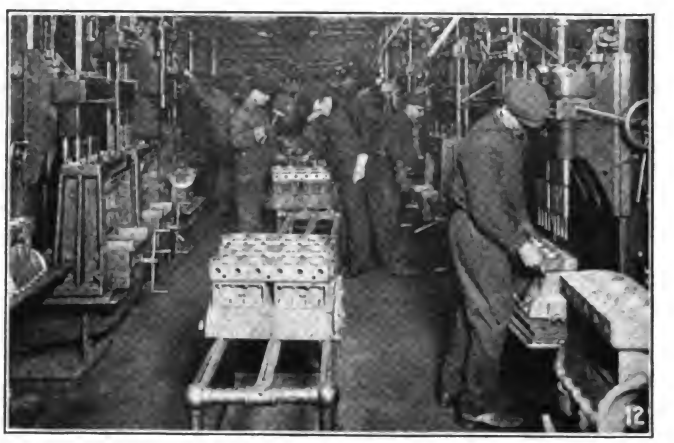


Fig. 12. Drilling and reaming for the valve stems.

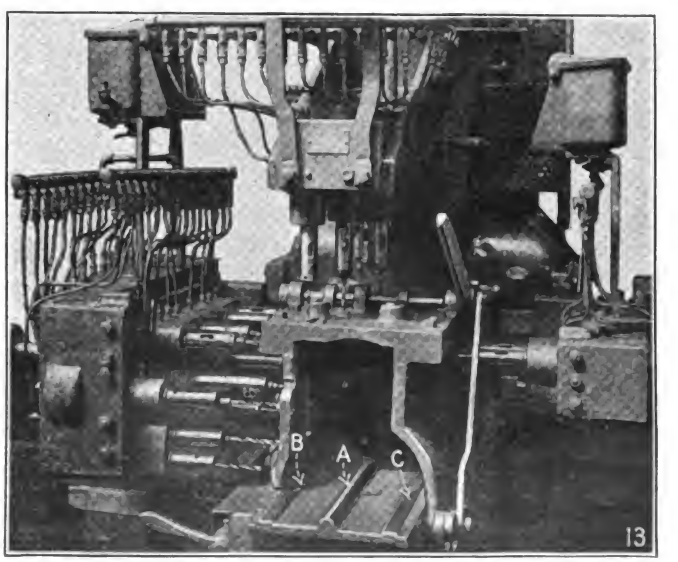


Fig. 13. A three-way special drilling machine.

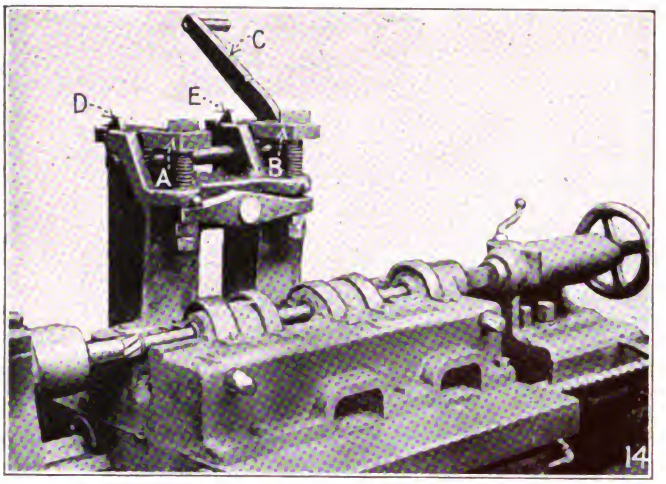


Fig. 14. Fixture for boring main bearing, shown in lathe between centers.

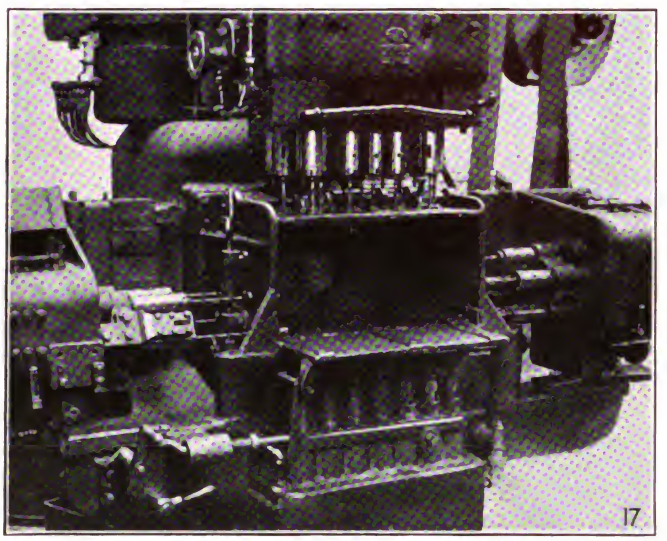


Fig. 17. Special four-way drilling machine working in cylinder blocks.

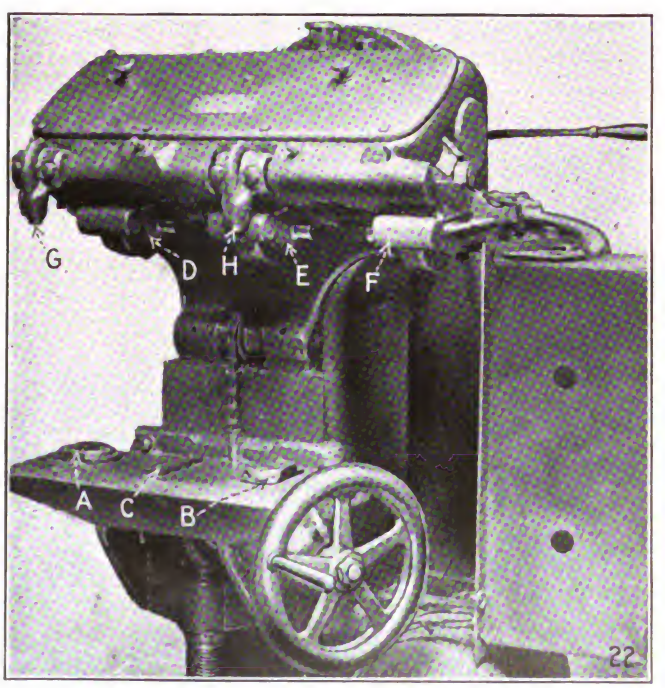


Fig. 18. Milling water slots in special three-spindle machine. Note cutters at A, B and C

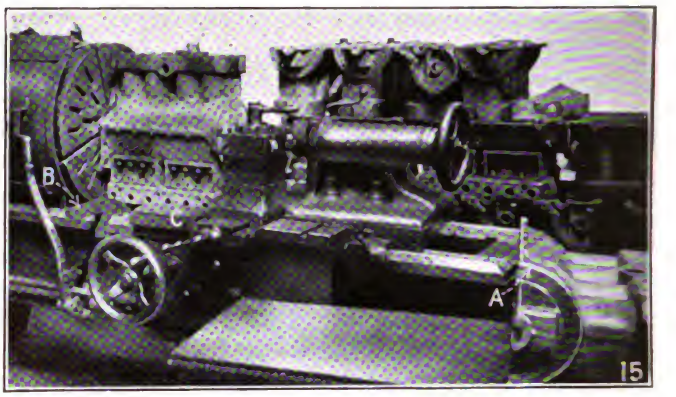


Fig. 15. Turning ends of crankcases bolted up in pairs, in large lathe

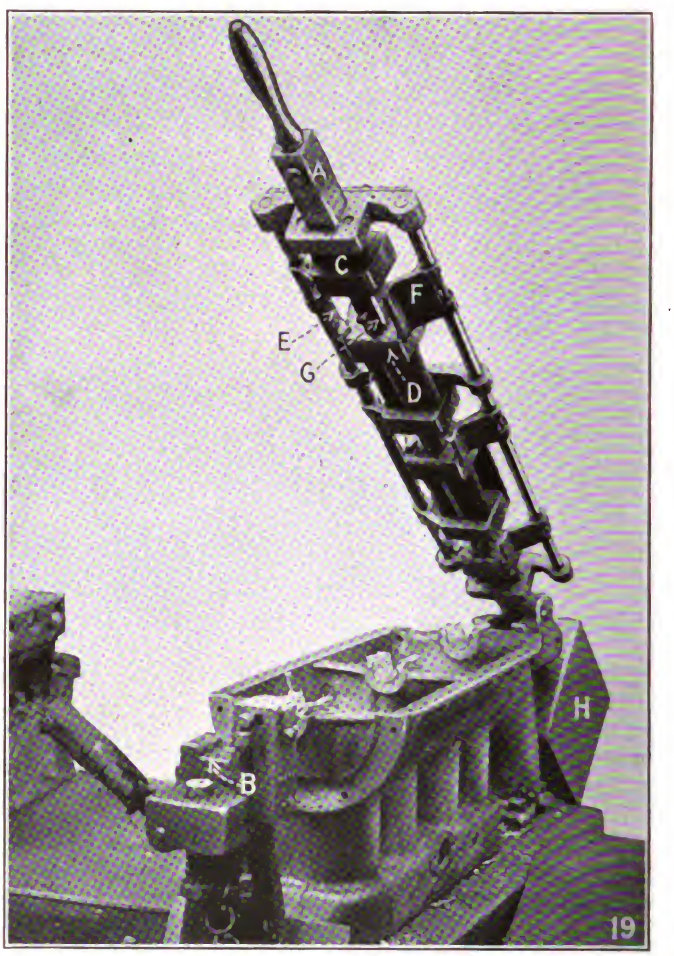


Fig. 19. Fixtures used in babbitting main bearings. Note counterbalance weight H.

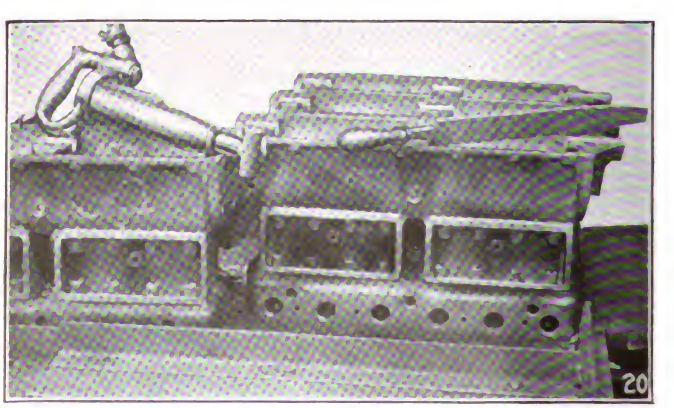


Fig. 20. Peening and trimming bearings with pneumatic hammer

which the cyclinder block goes to the special four-headed drilling machine shown in Fig. 17. This puts in the flange bolt holes, the holes for the cylinder cover studs and holes at each end for the transmission and other attachments.

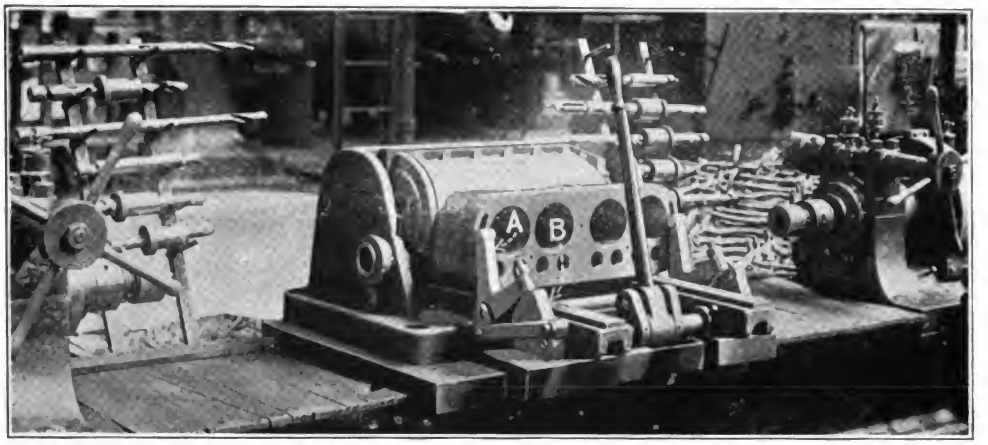
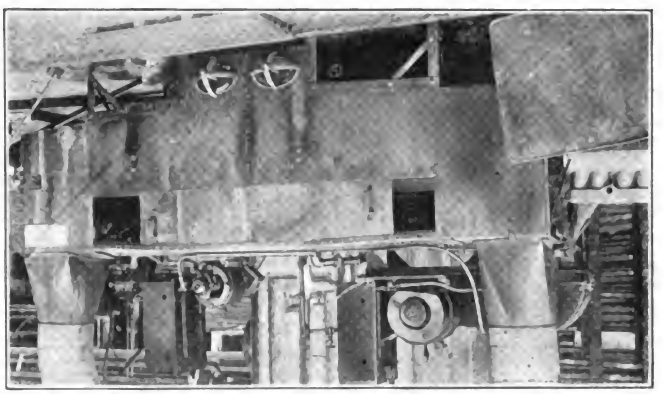


Fig. 16. Boring camshaft holes in double-headed machine.

Then follows the spot-facing of the holes in the bottom flange and the counter-boring of the six main bearing bolt holes, the drilling of tmo oil holes in the side of the cylinder, the clearance for the timing gear, and the drilling and counterboring of the holes for the water plugs, together with facing the crankshaft bearing bolt holes and spot-facing of the crankshaft cover holes.

The water slots are milled in the special three-spindle vertical milling machine shown in Fig. 18. This operation mills the three slots which make the water connection between the cylinder blocks and the cylinder head. The two outer slots are curved to conform to the bore of the cylinder, while the center slot is straight. The two outer milling cutters, A and B, are mounted in swinging arms so pivoted as to secure the proper radius, and a movement of the handwheel shown guides them over the full length of their travel. At the same time the central cutter C is moved across the cylinder to the correct distance. It will be noted that the milling cutters are of the new rapid spiral-tooth form.

Next comes the babbitting of the main bearing, utilizing the fixture shown in Fig. 19. With the cylinder block placed in position in the babbitting fixture, the arm A is swung down and locked into place at B. The blocks C and D form the cheeks or ends of the mold for the end bearing, while the pieces E and F form gates for guiding the babbitt down into the bearing around the mandrel G. The pin shown in the center acts as a guide and also forms an oil hole in the center



..Fig. 24. Washing the cylinders with soda before assembling.

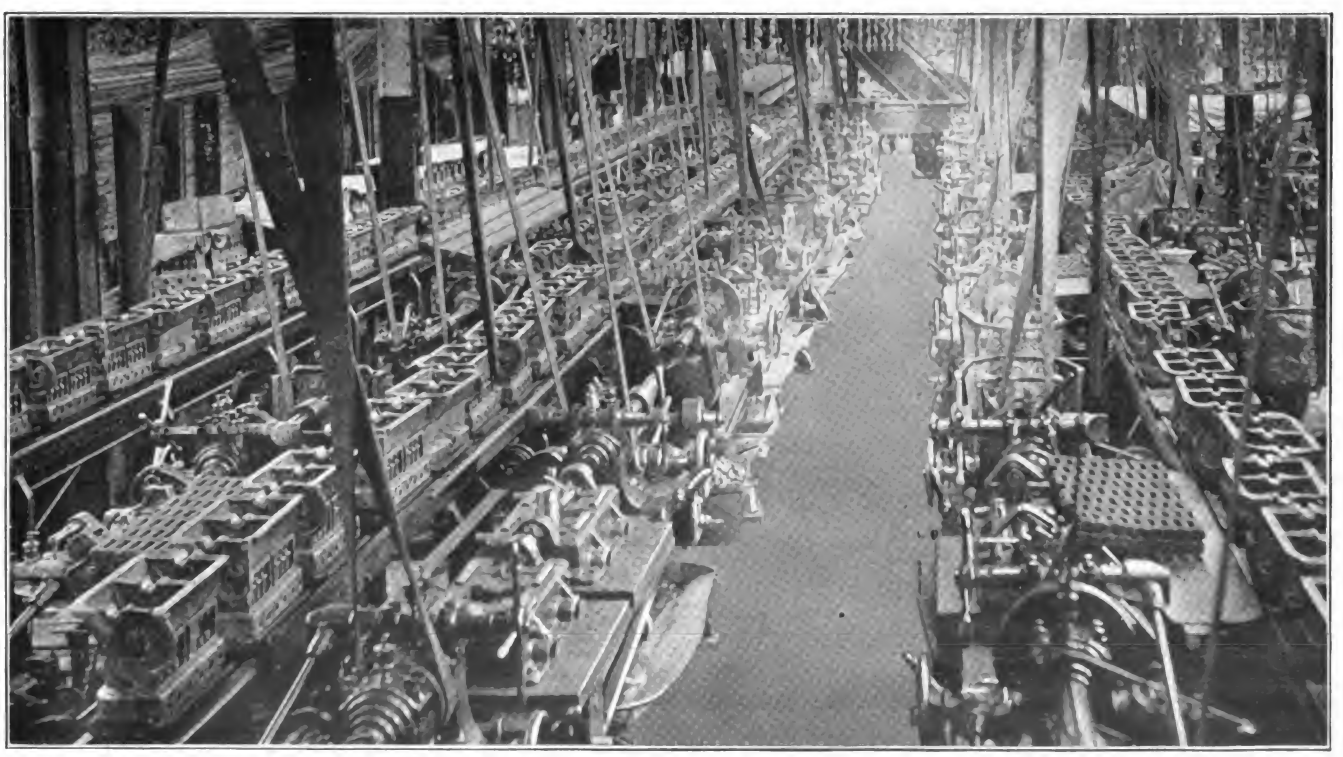


Fig. 21. Group of machines necessary in line-reaming the main bearings.

of the bearing. Similar guides are provided for the other bearing and the counterweight H makes it easy to handle the whole thing rapidly. The surplus metal is then chipped off and the babbitt peened solidly into place by the pneumatic hammer shown in Fig. 20. The edges are also trimmed with the file shown.

Then the bearing caps are bolted into position and the bearings bored and reamed in the machines shown in Fig. 21. This also shows the conveyors on each side and gives an excellent idea of the compact way in which all the machines are located. The cylinders are then taken to the special milling machine shown in Fig. 22. The blocks A and B fit the bore of the first and fourth cylinders, while the strip C supports the cylinder block in the center. The cylinder is then raised so that the cutters at D, E and F come between the crankshaft bearings, the stops G and H limiting the upward movement. The milling head is then moved sideways in both

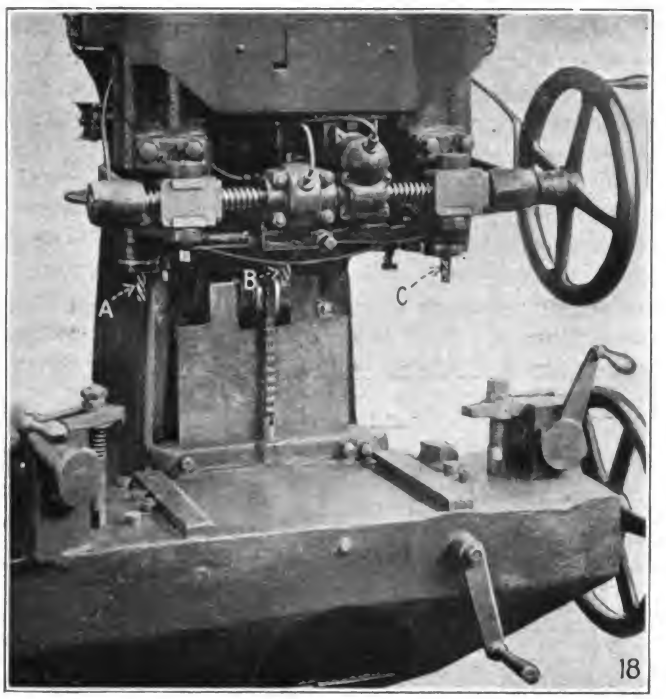


Fig. 22. Chamfering the ends of the main bearing

directions by means of a lever, and the ends of the bearing chamfered to the desired radius.

Instead of grinding as is done in most cases, the cylinders of the Ford motor are finished by rolling, as shown in Fig. 23. This is done on a heavy-duty four-spindle special drilling machine which carries the rolling tools, some of these being shown at A in the rack beside the machine. These are revolved and at the same time forced through the cylinders, being dropped out at the lower end. This compresses the metal and imparts to it a hard, burnished surface.

There remains a small amount of tapping to be done, after which the finished cylinder block is put on a conveying belt that carries it through the large washing machine shown in Fig. 24. Here it is treated to a scalding hot bath of soda water or some other mixture, and comes out entirely free from all dirt and chips, after which it is ready for the assemblers.

The Length of Wood Fibers

The current supposition that each species of wood has a characteristic fiber length is not borne out by the many thousand measurements which have been made at the Forest Products Laboratory on wood fibers. These measurements show that a greater difference may be found in one tree than exists between the average fiber lengths of different species.

In one Douglas fir disc, for example, the fibers varied from .8 to 7.65 millimeters (.03 to .3 inches) in length, which is a variation of nearly 7 millimeters. On the other hand, the averages of several thousand measurements on Douglas fir and longleaf pine were less than one millimeter apart, being 4.41 and 3.67 millimeters, respectively.

In the first case, 67 per cent of the fiber measurements in one tree fell between 4.5 and 6.5 millimeters, which roughly indicates the meaning of the common term "average fiber length" for the tree or species.

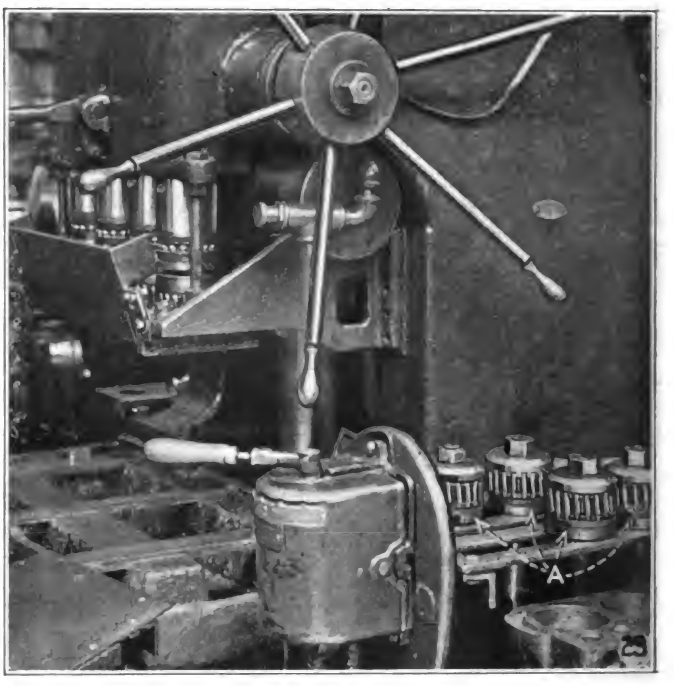


Fig. 23. Burnishing the cylinder bores with rollers.

Such data obviously can be of little value for identification purposes, because of the overlapping of the ranges of fiber length in the various species.

Some relations have been observed between the length of fibers and their position in the tree. During the first 20-50 years of growth, the increase in fiber length from the center of a tree outward in any plane is very striking. An approximate maximum having been attained, fiber length, though it may fluctuate somewhat, does not radically change thereafter, even in trees 400 or more years old. Some increase in fiber length occurs also for about two-thirds of the distance from the butt to the top. Within each annual ring the length of the fibers varies, particularly in the conifers, where the early springwood has the longest elements, and the last-formed cells of summerwood the shortest in the ring.

No clearly defined relation has been found between fiber length and the strength of wood. The longer fibers are often found in the weaker material.

New and Useful Ideas in Body Finishing

Body Lettering Almost A Lost Art

This mechanic, or, rather, artist, is less in evidence in the automobile and carriage panitshop than formerly. Years ago when the painter, as a rule, was an expert general workman, competent to take up and perform any of the various classes of work that came to the shop, the letterer or as he is more familiarly known to-day, the signwriter, was found in about every first-class shop. As a matter of fact, the shop in which a good letterer and ornamental painter could not be found was regarded as badly handicapped, as it really was. To-day you may hunt high and low in a majority of shops for the workman competent to do a good job of lettering, apply a monogram, or execute a decent looking scroll or ornamental figure. Nevertheless, there is a large field of work for the sign writer in the average custom or jobbing paintshop. Business of any kind develops though a capacity to take care of it, and whenever you find a shop prepared to do this class of work, you will find the man able to do it an exceedingly busy man for the most part.

Readers of this department, a majority of whom, we take it, are located in the smaller towns and villages, will find an increased source of revenue through an ability to handle this class of work in connection with their regular painting business. It is a feature belonging to the ornamental branch of the trade and should always be associated with it. Some men are born signwriters and ornamental painters, others acquire the art through patient study and practice. No painter, with an ideal, with aspirations for the higher things which the trade holds out, should neglect to secure the necessary knowledge and skill to enable him to do at least a fair, presentable job of sign work, monogram making, or simple scroll execution.

The successful painting business is made so only by taking advantage of every opportunity which it holds out, so that in the final summing up of the entire situation no reasonable excuse, in the great majority of cases, can be advanced for an inability to do, and do well,any and every class of work that is legitimately a part of the painting business. Opportunities, in plenty, exist for acquiring a good working knowledge and skill in the lettering and ornamental branches of the trade. There are schools of signwriting through which the work may be learned, through the medium of the mail; good correspondence schools teach it, and in the larger towns professional signwriters and ornamental painters can be found who, for a fixed sum, will arrange for a course of instruction of sufficient extent to give the beginner a good start on the way. This ornamental branch of the trade should include in connection with signwriting and monogram making, knowledge and skill in executing fine line ornamentation, striping, etc. The ability to execute elaborate pictures and embellishments on the side of the wagon or car or truck as one may see in the large cities, is probably beyond the expectations or the command of the majority of workmen. This pictorial feature of ornamental work is an attainment in art which usually represents about seventy-five per cent of natural talent and twenty-five per cent of acquired proficiency through practice.

Generally speaking, therefore, this branch will be found hardly worth while taking up unless the learner has for his object the field of the specialist. In the great centers of vehicle fashion and style the pictorial artist is, for the most part, a specialist devoting his time and talent to the one particular branch. Unless specially gifted in this line of endeavor the carriage and automobile painter will scarcely find it to his interest to largely concern himself with this branch of work. What he should aim to do, however, is to become, as already urged, competent to do a good, strictly up-to-date class of striping, fine line ornamentation, and a job of lettering that will pass among critics as "well done." Capable of doing this work, he will find open to him a large source of profitable revenue. Moreover, no cleaner, finer, more sanitary branch of the trade is to be found There is a fascinating art side to the work which for those trained in it has a reward outside and apart from any mere financial compensation. In the town of considerable size, the competent letterer will also find work to do outside of his regular shop duties which will enable him to considerably increase his income and to keep busy during periods which the ordinary paintshop force accepts as "slack time." Signwriting for business houses, offices and miscellaneous business is practically always in order, and a little effort on the part of the painte,r will get this work.

Painting and Finishing Yellow Surfaces

Automobile and carriage painters who are inexperienced in handling the various tones and shades of yellow sometimes meet with difficulty in securing good covering conditions. The work looks weak and streaked, and fails to have the necessary density of color. This difficulty is overcome very largely, at any rate, by using proper ground coats and eliminating oil from the final coats of yellow. Oil is ruinous to the purity of color of practically all yellow pigments. The best ground color for yellow, all things considered, is a light gray or a blank white surface. Personally, the writer prefers white to gray for this work.

For the priming coat on new work use white lead ground in oil and thin with sufficient turpentine to give the completed mixture three parts of raw linseed-oil to one part of turpentine. On poplar panels the percentage of oil may be increased to four parts oil and one part turpentine. The second coat to be of white lead carrying equal parts of raw linseed-oil and turpentine. For the third coat, one part oil to four or five parts of turpentine with the blank white effect still maintained, will furnish a sufficiently solid and dense perparation coat for the yellow.

Apply next a flat coat of the yellow selected for the work, using about thirty drops of rubbing-varnish to each pint of the mixture when thinned with turpentine. This will give the necessary binders to the color and insure the maximum covering power. The next coat of yellow should be in the form of varnish-color. That is, after

thinning the color to a ream-like consistency with turpentine, add sufficient clear rubbing-varnish—the palest varnish possible to procure—to give a stout gloss to the coat when dry. Another coat of this same mixture should follow, each coat being rubbed lightly with water and pumice stone. The coat following should consist of clear rubbing-varnish with enough of the yellow added to maintain the original purity of the yellow. Rub this coat down with pumice stone flour and water and apply all striping and ornamental effects. Over this apply a very pale rubbing-varnish except in the case of the lightest yellows. These latter should carry some of the color even in the last coat of rubbing-varnish, the striping being placed above this coat and alone protected by the finishing-varnish which should be pratially a water-white varnish. Applied and finished in this way all yellow pigments can be handled successfully.

Quick-Drying Lacquer Coatings

Coatings of a rapid drying nature were required during the war period for many types of manufactured products. Tung oil varnishes, cut with a high percentage of volatile spirits, were used for the base of many of these coatings. It was found, however, that where greater rapidity of drying was required, spirit varnishes of the shellac type were necessary. Later on, speed of production on some products demanded the use of finishes that would dry within a few minutes, and cellulose lacquers or "dopes" were adopted with successful results. Such "dopes" were already in use for making moisture resistant and rendering taut the fabric wing surfaces of air craft. They were composed of either cellulose acetate or cellulose nitrate dissolved in volatile solvents. For air-craft work their composition resembled those shown below:

Cellulose Acetate Dope

Methyl acetate	60%
Methyl ketone	10%
Benzol	15%
Acetone	10%
Diacetone alcohol	5%

Each gallon of dope made with the above liquids contained approximately 7 to 9 oz. of cellulose acetate, 1 oz. triphenylphosphate, and very small quantities of chemicals such as benzyl acetate, benzyl benzoate, and urea.

The various stablizers and other solid ingredients in the dopes were used for specific purposes (such as to increase fire resistance and flexibility, or to prevent the development of free acid or "blushing"), but are not usually required where the "dopes" are to be used only as protective coatings.

Cellulose Nitrate Dope

Butyl acetate	20%
Ethyl acetate	50%
Benzol	30%

Each gallon of "dope" made with the above liquids contained from 6 to 8 oz. of cellulose nitrate.

Cellulose nitrate "dope" is greatly improved as a protective coating by the addition of from 5% to 7% of castor oil or treated tung oil. Greater elasticity of film, and slower evaporation result.

It is quite possible that cellulose nitrate lacquers made on the above basis will find application in peace times for certain specific purposes where quick-drying, hard, and elastic films are required. They may be admixed with pigments to produce colored coatings which dry to a flat, washable surface. When mixed with aluminum powder or zinc powder,, quick-drying, hard primers for metal are formed. These may be used satisfactorily as the base for many metal finishes. As substitutes for shellac on some types of work they should also prove of value.

For coating shells and similar metal objects these paints should prove efficient, as they may be applied by spray, brush, or dipping, drying almost immediately to a moisture resisting, flexible film. Baking at a low temperature is permissible.

The writer has found clear or colored cellulose nitrate lacquers to act as excellent primers for certain types of cement floors that are to be painted. Through their use, waterproofing greases or other materials in the cement are insulated from action on subsequently applied enamels.

It should be pointed out that cellulose lacquers or enamels are not as durable as those made with oil or varnish. They are, however, useful for certain purposes where the longevity may be partly sacrificed to obtain rapid drying. —H. A. Gardner, Inst. for Ind Research.

General Utility Ford Delivery

(Continued from page 11)

shown below is standard to a great extent and can be used to advantage by tradesmen without any changes.

The body is 56 inches high, 7 feet 8 inches long, and 44 inches wide. The side panel is 15 inches high, with a flare board at its upper edge. There are six posts, four needed to support the driver's cab and two at the rear end.

The sides of the cab consist of boards which rest on the upper edge of the side panels, and which have openings cut out, for the insertion of a window, which can be either a drop window or fixed.

The flooring consists of two end sills front and rear, two side sills and one center, between which rest the two floor boards. Smaller boards may be used, in which case the body will be a little more flexible and will resist a tendency to warp.

This sort of a body is usually provided with curtains that can be rolled down at the sides and rear, as shown in the illustration, but some expense is saved by leaving them off if protection from the rain is not needed for the kind of load it is expected to carry.

The weight of this body design is about four hundred pounds, with the dimensions as stated above. It is not a very long body, and for this reason is unavailable for some purposes, such as carting lumber. But where extra length is needed solely for more floor space, to carry a larger load of smaller articles, it may be made slightly longer. Do not make it more than a foot longer, however, and even then care will have to be taken in loading to make sure that the heaviest weight is forward; otherwise weight in that part of the body which extends beyond the chassis will have a big leverage and either break the body or rip it from the chassis.

The Tampico district of Mexico shipped to the United States in December, 1919, 6,059,937 bbls. of petroleum, or at the rate of almost 73,000,000 bbls. a year.

Underwriters Working For Greater Safety

In the hope of wiping out entirely the avoidable automobile accident; in so doing to save at least 10,000 lives and millions of dollars annually, and to remove from the motor vehicle the stigma "dangerous machine," the Underwriters Laboratories with the assistance of the National Safety Council are now carrying on extensive experiments with appliances for the prevention of automobile accidents.

The use of laminated glass for wind shield construction, wind shield cleaning appliances, the construction of steering gears, and the whole subject of head lamp dimmers and diffusers are involved in the tests under way. While the laboratories are conducting these tests with mechanical sources of automobile accidents and their prevention, the National Safety Council through its local councils is making a study of all traffic accidents. The report of W. L. Patterson who is carrying on this work for the Central Mississippi Valley Division of the National Safety Council covering traffic accidents in the city of St. Louis during March of this year reveals the following:

Number of fatalities from automobile accidents	11
Number of street accidents of all kinds	791
Number of automobile accidents	494
Number injured in automobile accidents	187
Number injured in motorcycle accidents	111
Number injured in bicycle accidents	15
Number injured in horse drawn vehicle accidents	7
Number injured in street car accidents	44
Property Damages	$39,500.50
Causes not determined	190
Causes given as unavoidable	81
Skidding	91
Driving on wrong side of street	3
Parked too close to tracks	3
Mechanical defects in automobile	20
Jay Walking	27
Careless driving	205
One automobile trying to pass another	9
Failing to stop at crossing without giving signal	4
Pulling away from curb without giving signal	7
Automobiles passing street car while discharging passengers	1
Backing automobile without giving signal	11
Stopping without giving signal	3
Turning without giving signal	9
Horses left unguarded	4

In a communication to the headquarters of the National Safety Council of Chicago the Underwriters Laboratories says.

"The stock insurance companies are at the present time giving reductions in insurance rates for the use of listed fire extinguishers and locking devices and they have recently advised us that the use of bumpers which have been found acceptable by us as a result of tests, will entitle the car owner to a substantial reduction in the collision insurance rate. Further, certain other devices which should result in a reduction in collisions, will be recognized in the Collision Schedule by substantial reductions, i. e,. an automobile traffic signal installed on an automobile and so designed as to indicate the intentions of the driver with respect to stopping or turning should reduce the number of collisions.

"We have for several years been testing automobile traffic signals not only by actual road tests to show their suitability for use and effect upon drivers following, but also by durability tests to determine whether they would last for the life of the automobile on which they were installed. Up to the present time we have tested some five or six of these traffic signals and have listed only one. The main trouble with these devices appears to be that they will not be sufficiently durable to last for the life of the automobile on which they are installed. In fact, in some cases where electric traffic signals have been employed, the construction was such as to offer a marked increase of fire hazard to the automobile on which it was attached due to defective wiring, defective methods of installation, etc. We now have before us several traffic signals which apparently possess some merit, as indicated by the results thus far outlined.

"The use of laminated glass for wind shield construction is a comparatively new feature in automobile work and considerable attention is being given to this item at the laboratories at the present time. It can be readily seen that with the use of a suitable form of laminates glass, injuries due to collisions will be markedly decreased if the flying glass hazard is reduced to the minimum. While only one form of laminated glass has thus far been listed for this service, three or four other manufacturers have either submitted their product for examination or have signified their intention of so doing in the near future.

"The application of wind shield cleaners to automobiles is of marked advantage in reducing the possibility of accidents from collision, and this organization is doing considerable work in testing such devices.

"We are now arranging to make tests of steering gears wherein the gears will be mounted upon a stand and be operated a number of times equivalent to what would be expected on an automobile after five years of severe service in order to determine the possibility of accidents occurring due to defective construction. Up to the present time no steering gears have been listed but we expect to do considerable work along this line in the near future.

"The subject of head lamp dimmers and diffusers has received some attention from us and we have developed means whereby the 'glare' can be defined in terms of apparent candle power. As you know, a number of states have legislated concerning the use of head lamps but only one or two, principally California and Wisconsin, have considered the possibility of actually making tests to determine scientifically the so-called 'glare' factor."

Relative Durability of Various Kinds of Fir

Before the preservative treatment of ties was practised as extensively as at present, the railroad companies using Douglas fir ties held the opinion that the Douglas fir grown in the Rocky mountains was more durable than that grown on the Pacific coast. In some of the copper and lead mines in the Rocky mountains also the mountain fir was considered more durable.

No authentic records are available where coast and mountain fir ties are set in the same locality. Such service records as there are fail to show that the mountain fir has superior lasting qualities. In some instances the mountain fir and in others the coast fir has proved more durable.

Botanically there is no difference in Douglas fir according to the locality in which it grows. Tests made by the Forest Products Laboratory, Madison, Wis., indicate that Pacific coast fir is on the average somewhat denser and therefore stronger and harder than mountain fir. However, the parts of coast timber usually cut into ties are boxed hearts or wood cut near the piths or from the tops of trees. These are the poorer parts, and coast fir ties generally contain no better wood than mountain fir ties.

The conclusion of the laboratory is that there is practically no difference in the durability of Douglas fir ties cut in the mountains and those cut along the Pacific coast It has been observed though, that the latter receive preservative treatment a little more readily than the former.

Current Automotive Metal and Supply Prices

Iron and Steel Resumption of freight service has helped dispose of a conside.able accumulation of iron and steel, but many manufacturing plants have been obliged to close down. More blast furnaces are in operation, and production in general is again trending upward.

Copper and Aluminum Strikes in the West and the Naugatuck Valley in the East have tied up the brass and copper industries. Prices are largely nominal in a sluggish market, as a result. Electrolytic has moved upward slightly and is quoted on a par with lake. Aluminum is still dull, but outside interests are offering virgin 99 per cent metal at 31½c.

Lead and Tin The damper which the strike put on consuming interests has had an unfavorable influence on the lead market. Second hands and speculative interests are making concessions in price, but the leading producer holds firm around 9¼c New York. Tin is easier but very little business is being done. April arrivals to the 27th totalled 3,008 tons, with 3,096 reported afloat.

Zinc and Other Metals Reselling by exporters who can replace their metal on the other side at lower prices has caused a dent in the market. Decline in sterling exchange has had an unfavorable influence also. Late in April, the price reached 8¼c New York for prime Western with a possibliity of lower figures. Antimony is firm but quiet around 11c. Silver is materially lower, passing below $1.10 on May 4 and reaching $1.05¼ on May 6. Mercury is up, reaching $103 per flask the last of April. Ferromanganese is $250 for prompt.

Old Metals Prices are unchanged but there is a generally better feeling throughout the trade.

Chemicals The feature of the market has been the tightness of supplies. A few chemicals have moved up due to continued demand and lack of supplies. Nickel salts and caustic soda are up, soda ash is nominal. Turpentine is still $2.50 nominally, but none is available.

Fabrics The only changes in the fabric market have been indications of lower prices, although raw cotton went higher on adverse crop reports. The strikes at the mills may raise prices. Fine wools are higher.

Other Materials All rubbers are materially easier, upriver fine Para being down to 40½ @ 42. There is no change in oil price, but continued shortage predicates early increases. This refers to raw materials, finished products are up, some of the lubricants by a considerable amount. Hides are firm.

Every effort is made to have the following prevailing prices (compared with last month's) accurate but none is guaranteed. They are obtained through trade sources and may not be realized on small quantities:

	Apr. 6	May 1
Acid, Sulphuric, 66°.....ton	$22.00 —25.00	$22.00 —$25.00
Alcohol, Ethyl, 97 p.c.....gal.	6.00 — 7.00	6.00 — 7.00*
Alcohol, denatured, 190 proof, gal.	.98 — 1.02	.98 — 1.02*
Aluminum, Ingots No. 1 99% pure, carload lots.....lb.	.33	.33
Ammonium Chloride (Sal-Ammoniac) white, granular....lb.	.16 — .18	.17 — .18*
Babbitt Metal, best grade.....lb.	.90	.90
Babbitt Metal, Commercial....lb.	.50	.50
Beeswax, natural crude, yellow.lb.	..	..
Carnauba No. 1 Wax.....lb.	.80 — .88	.80 — .88*
Caustic Potash (85-92 p. c.)..lb.	.30 — .35	.30 — .35
Caustic Soda, 76 p. c.....100 lb.	6.10 — 6.25	7.00 — 7.50
Pumice, Ground (domestic)....lb.	.02½	.02½
Shellac, Orange, superfine....lb.	1.50 — 1.55	1.60 — 1.65
Tin, Metallic straits pig.....lb.	.65	.64
Turpentine, spirits of crude.....	2.35	2.50*
Zinc, Western Spelter.....lb.	.10¼— .11¼	.09 — .10
No. 9 base casks, open.....lb.	.14½	.14½

*Nominal

IRON AND STEEL, PIG, BARS, ALLOYS, OLD METAL

Pig, per ton—	Apr. 6	Apr. 30
No. 2 X, Philadelphia§.....	$47.05	$47.05
No. 2, Valley furnace†.....	43.00	43.00
Basic, delivered, eastern Pa.....	44.80	44.80
Basic, Valley furnace.....	42.00	43.00
Bessemer, Pittsburgh	43.40	43.90
Malleable, Valley	43.00	43.00
Bars—		
Merchant iron, base price.....	....	....
Refined iron base price.....	4.75c	5.00c
Soft Steel—		
¾ to 1¾ in., round and square..	3.52—4.75c	3.52—5.00c
1 to 6 in. x ¾ to 1 in.....	3.52—4.75c	3.52—5.00c
1 to 6 in. x ¼ and 5/16.....	3.62—4.85c	3.62—5.00c
Rods—⅝ and 11/16.....	3.57—4.55c	3.57—4.80c
Bands—1½ to 6 x 3/16 to No. 8..	4.22—5.75c	4.22—5.25c
Ferromanganese, 76% to 80% delivered producers' price.....	$200.00—225.00	$250.00
Spiegel, 18% to 22% furnace, spot	55.00— 70.00	62.00— 67.00
Ferrosilicon, 50%, spot, delivered	85.00— 90.00	85.00— 90.00
Ferrotungsten, standard, per lb. contained, furnace	.90— 1.10	.90— 1.10
Old Metal		
Heavy steel scrap, Pittsburgh...	27.00	25.00
Heavy steel scrap, Philadelphia..	24.50	24.00
No. 1 cast, Pittsburgh.....	34.00	22.00
No. 1 cast, Philadelphia.....	38.00	38.00

†Silicon, 1.75 to 2.25. §Silicon, 2.25 to 2.75.
Ferrosilicon prices at Ashland, Ky., Jackson and N. Straitsville, O.

BOLTS AND NUTS

	Apr. 6 % off list	May 1 % off list
Machine bolts, c.p.c. and t. nuts, ⅜ x 4in.; Smaller and shorter..	35	35
Carriage bolts, ⅜ x 6 in.:		
Smaller and shorter, rolled threads	40— 5	40— 5
Cut threads	30—10	30—10
Semi-finished hex. nuts:		
⅜ in. and larger.....	60— 5	60— 5
9/16 in. and smaller.....	70— 5	70— 5
Tire bolts	55—10	55—10

The above discounts are from November 1, 1919.

BRASS, COPPER SHEETS, SHAPES, VIRGIN METAL, SCRAP

	Apr. 6	May 1
Copper, Lake, ingot.....lb.	$0.19½	$ 0.19¼
Copper, Electrolytic .....lb.	.19¼	.19¼
Copper, Casting .....lb.	.19	.19
Copper sheets, hot rolled.....lb.	.29½	.29½
Copper sheets, cold rolled.....lb.	.31½	.31½
High brass wire and sheets....lb.	.25¼	.25¼
High brass rods.....lb.	.23¾	.23¾
Low brass wire and sheets....lb.	.27¼	.27¼
Low brass rods.....lb.	.28	.28
Seamless bronze tubing.....lb.	.32	....
Seamless brass tubing.....lb.	.33	.30½
Old Metal—		
Copper light and bottoms.....	.14½	.16¼
Brass, heavy	.10¾	.14
Brass, light	.08	.10
Heavy machine composition.....	.16	.18¼
No. 1 yellow brass turnings.....	.09¾	.11½
No. 1 red brass or comp. turnings	.12¾	.16

CRUDE RUBBER

	Apr. 7	May 1
Para, Upriver fine.....lb.	$0.42	$ 0.40½— .42
Upriver coarse .....lb.	.32	.30½— .32
Upriver caucho ball.....lb.	.32	.32½— .33
Plantation, first latex crepe...lb.	.46	.44 — .45
Ribbed smoked sheets.....lb.	.45½	.44½ ..
Brown crepe, thin, clean....lb.	.45	.42

PETROLEUM PRODUCTS

	Apr. 7	May 4
Oil—Pennsylvania Crude	..$6.10	$ 6.10
Kansas and Oklahoma Crude..	3.50	3.50
Gasoline,Motor,garages,steel bbls..	.28½	.28½
Consumers, steel bbls.....	.30½	.30½
Lubricating Oil, black, 29 gravity	.25—.35	.28— .35
Cyl. light filtered.....	.72—.80	.90— .95
Dark filtered	.70—.75	.80— .82

Men of the Automotive Industry

Who They Are What They Are What They Are Doing

A. C. Bergmann took up on May first his duties as general sales manager of the Sterling Motor Truck Co. of New York, with headquarters at One Hundred and Thirty-second street and Twelfth avenue, New York city. For the past five years, Bergmann has been New York branch manager for the Standard Parts Co., beginning with service work and for the past three years in charge of the entire Eastern territory on spring and axle sales. Previous to that he held executive positions with the Mercer, Fiat and Simplex companies. He is chairman of the Metropolitan Section, S. A. E.

James G. Sterling, for over eighteen years chief engineer of the F. B. Stearns Co., Cleveland, Ohio, has left the Stearns Company and has formed a syndicate among some of the strong financial institutions of that city, headed by P. H. Withington, of the Sparks-Withington Co., who is manager of the syndicate. Sterling will head a new company, backed by the temporary syndicate, which will produce a six-cylinder Knight-engined car of a high grade.

R. R. Zimmer has joined du Pont Motors, Inc., Wilmington, Del., in the capacity of chief engineer, and will be in charge of the new du Pont automobile, which is now expected to be on the market about June 1. Zimmer has been designing engineer of the Simplex Automobile Co. and the Wright-Martin Aeronautical Motors Co. Back in 1904 he was associated with the Crane Motor Car Co. as designer.

A. G. Phelps has assumed the duties of chief engineer of the Elkhart Carriage & Motor Car Co., Elkhart, Ind. Phelps has for eight years been connected with the Dayton Engineering Laboratories Co., with which organization he has had experience with the production, inspection, sales and engineering divisions. For the past two years, he has held the position of sales manager of that company.

Edgar Apperson has been elected president of the Apperson Brothers Automobile Co., Kokomo, Ind., succeeding to the post so long filled by his brother, the late Elmer Apperson. Mrs. Elmer Apperson was elected at the same time to the directorate, filling her husband's place on the board. A. G. Dawson, formerly cashier of the company, has been elected to the secretary-treasurership.

Walter H. Schimpf, who resigned as eastern district manager for the traffic department of Paige Motor Car Co., is president of the Larchmont Motors Corp. Schimpf has been in the industry since 1899, when he was with the Mobile Co. of America, Tarrytown, N. Y., and has been associated with White Steamer, Winton, Stanley, Cadillac, Oldsmobile and Stoddard-Dayton.

John F. Alvord, president and director of Hendee Mfg. Co., Springfield, Mass., has resigned, and Henry H. Skinner, Springfield, elected to fill the vacancy. F. J. Wechsler, treasurer, has been made vice-president of sales, financing and auditing, and Lieut. Col. Lindley D. Hubbell, commandant, Springfield armory, vice-president of operations and a director.

Karl M. Wise, who has figured in Detroit engineering circles as a consulting engineer has been made consulting metallurgist of the Russell Motor Axle Co. Wise has devoted his time in recent years to work of a purely engineering nature, through affiliation with the Detroit Engineering Laboratories and later with the American Engineering Associates.

Fred G. Kimmel, vice-president in charge of engineering, and E. F. Davison, treasurer of the Rochester Motors Corp., Rochester, N. Y., resigned from their respective offices on April 1. The treasurership is filled by W. G. Hoffman, Jr., who also acts in the capacity of secretary, and Gordon Grand has been made vice-president.

Dent Parrett, since its organization head of the Parrett Tractor Co., Chicago, has resigned from that post to take up his work as president of the Parrett Motors Corp. The new corporation proposes to enter the market with a broad line of power farming machinery built around a new Parrett motor cultivator.

Christian Girl has completed the purchase of the Kalamazoo Spring & Axle Co., and on May 1 took over its management as president and general manager. Together with a number of associates, including several of his old and time-tried organization, Girl has acquired complete control of the business.

G. E. Stoitz, general engineer, Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa., has been appointed engineer in charge of the steel mill section of the Engineering department. W. E. Thau, general engineer, has been appointed engineer in charge of marine section of the Engineering department.

R. E. Cole, who has been for the past four years engineer of the Liberty Motor Car Co., Detroit, has resigned from that post. Cole, who will be recalled as at one time member of the Chalmers engineering staff, and later for his work on the design of the Saxon, has not made public his future plans.

L. H. Keim, manager of the tractor gear department of the R. D. Nuttall Co., Chicago, has been promoted to general sales manager, in which he will have the direction of sales in all fields covered by the company. Mr. Keim will move to Pittsburgh, the home officer of the Nuttall company.

W. M. Pepper is chairman of the board and acts as treasurer of the Rubber Corp. of America, in addition to being president of the Empire organization. E. I. Reynolds is president, while the first vice-president is C. A. Bates, now president of the Sterling Company, who is in charge of advertising.

H. H. Biggert has been made a vice president of the Emerson-Brantingham Company. Mr. Biggert's duties will cover the general supervision of the production of the eight E.-B. factories, continuing along the lines he has been supervising since joining the company last year.

Orton C. Beacraft has joined the Keystone Motor Truck Corp. Oaks, Pa., in the capacity of production manager. Beacraft comes to the Keystone Company from the Bethlehem Motors Corp., where he was general superintendent and factory manager of the Pottstown plant.

E. F. Axner, for many years in charge of pig iron sales for the Illinois Steel Co., Chicago, whose resignation was recently announced, has been elected treasurer of the Aetna Ball Bearing Mfg. Co., 213 Institute Place, Chicago.

W. T. Walker, who for some time past has been closely identified with the Powerlok Co., Cleveland, Ohio, has resigned as president and general manager of the organization. Just what his plans will be have not as yet been revealed.

H. J. Crean has been appointed assistant to President R. A. Palmer of the Collier Mootr Truck Co., Bellevue, O. Crean comes from Fisher-Wilkie, Ltd., of Sandwich, Ont., where he acted as assistant secretary-treasurer.

Herman C. Menge, superintendent the Tuthill Spring Co., Chicago, for the past 25 years, has resigned to take a third interest in the Garden City Spring Works, Chicago.

Howard Wilcox, well known racing driver, has been appointed research engineer of the Cole Motor Car Co., Indianapolis, Ind.

Additional Notes of Parts Makers

Automotive Foundry Co., La Crosse, Wis., is erecting a brick and steel gray iron shop, 100 x 220 ft., which will be ready for operation about June 1. It is incorporated for $100,000 and will furnish castings to the La Crosse Tractor Co. and other local and outside industries. A. A. Rasmussen is works manager.

Canadian Tygard Engine Co., Ltd., Lawler Avenue, Toronto, has started excavation work for a two-story addition to cost $30,000. It will be used for the manufacture of airplane engines, rotary steam engines and fuel-mixing vibrative carburetors and is expected to be in operation by July.

Dual Tractor Co., Rochester, manufacturer of tractor parts, etc., has increased its capital stock from $10,000 to $100,000.

Fafnir Bearing Co., New Britain, Conn., is erecting a six-story plant addition 137 x 50 to be utilized for the manufacture of the company's new hanger box.

Yale Piston Ring Co., 560 West Thirty-sixth Street, New York, is planning for the early occupancy of its new plant on Myrtle Avenue, Boonton, N. J., now practically completed. During the spring and summer it contemplates the erection of four additional buildings at this location.

Hardy Radiator & Motor Support Co., Little Rock, Ark., recently organized, is planning for the establishment of works for the manufacture of automobile radiators and other sheet metal products. S. R. Thomas is president and J. E. England, Jr., treasurer.

General Motors Corporation recently purchased property valued at over $450,000 in Dayton, including that of the Dayton Metal Products Co., L. G. Lehman & Sons, and the S. H. Rothenburg Tobacco Co., which it is now occupying.

Rubber Corporation of America has been capitalized at $2,000,000 to take over the sale of all products of the Empire Rubber & Tire Co., Trenton, N. J., Sterling Tire Corp., Rutherford, N. J., and another concern in the middle west.

Herschell-Spillman Co., North Tonawanda, N. Y., manufacturer of automobile motors, has awarded a contract to Hardin & Crea, White Building, Buffalo, for the erection of a four-story addition, 63 x 150 ft., to cost about $200,000.

Liberty Starter Co., Detroit, has begun operations in its third factory unit at Jefferson avenue and Fifteenth street. It now employs 1000 and the daily production has reached 2000 motors and generators.

Norma Co. of America, 1790 Broadway, New York, manufacturer of ball, roller and other bearings, with plant on Anable avenue, Long Island City, has increased its capital stock from $300,000 to $750,000.

Sunlite Co., McKinney, Tex., manufacturer of automobile lamps, lenses, etc., is having plans prepared for a new one-story plant to cost about $100,000 including equipment. E. R. Brackett is engineer.

Diefendorf Gear Corporation, Syracuse, N. Y., has been incorporated with a capital of $150,000 by W. H. and M. A. Diefendorf, and W. F. Canough, to manufacture gears and other metal products.

S. K. F. Ball Bearing Co., 330 New Park Avenue, Hartford, Conn., has awarded a contract to the J. H. Grozier Co., 721 Main street, for a one-story addition, 50 x 153 ft., to cost about $25,000.

Mura Motors Corporation, New York, has been incorporated with an active capital stock of $220,000 by G. W. Rollo, E. F. Hills and D. Robinson, 154 Nassau street, to manufacture automobile engines.

Motometer Co., 15 W Bur avenue, Long Island City, N. Y., has acquired property, 20 x 100 ft., on Sunswick avenue, near Wilbur avenue.

Federal Bearing Co., Fairview street, Poughkeepsie, N. Y., will build a three-story plant.

Activities of Automotive Manufacturers

Where They Are Located What They Are Doing How They Are Prospering

American Motors Corporation, West Front Street, Plainfield, N. J., manufacturer of automobiles, has organized the Plainfield Body Corporation, with capital stock of $250,000, to manufacture automobile bodies to be used at the local plant, as well as the company's branch works at Greensboro, N. C. Arrangements have been made to occupy a portion of the plant of the parent company, pending the erection of a building for this branch of the business. Plans for the proposed works are being prepared to provide an initial space of about 40,000 sq. ft. The output will be about 7000 bodies per year and for the present production will be restricted to touring car and roadster bodies. Robert Bursner is president of of the Plainfield Body Corporation, and Guy Morgan, vice-president and general manager. Hiram F. Brown will be in charge of factory operations.

Commercial Motor Trucks, Ltd., the Canadian branch of the Commerce Motor Car Co., Ltd., Detroit, Mich., will establish a branch factory in Guelph and plans have been prepared for the erection of a plant. Construction will start within 30 days and operations are expected to begin next October. It is the intention of the company to purchase locally many of the parts which will be required for assembling the motor trucks. The directors of the Canadian company are: Walter E. Parker, E. M. Baker, Charles L. Granger, George D. Cox, all of Detroit, and J. M. Taylor, F. E. Pantridge and J. E. Carter, Guelph. The plant will be constructed on a site of 25 acres, opposite the Monerief Furnace Co., on the York Road.

Studebaker Corporation, South Bend, Ind., manufacturer of automobiles, is planning for the early occupancy of several new plant units now in course of erection, which include a four-story, reinforced-concrete structure, 192 x 528 ft., for assembling and sub-assembling work, comprising tool departments, machinery maintenance and repair works, storerooms and other mechanical departments. A one-story, steel frame building, 183 x 528 ft., will be equipped as a stamping department and for enameling operations. Other buildings are a one-story machine shop, 425 x 576 ft.; forge shop, 161 x 742 ft., and electric power plant. The total area of the new buildings is 1,206,800 sq. ft.

Wright Aeronautical Corporation of America, 40 Wall Street, New York, has decided to defer the erection of its proposed new plant at Newark, N. J., estimated to cost about $300,000. For occupancy about May 1, it has leased a four-story, steel and concrete building, 75 x 300 ft., as Paterson, N. J., with adjoining site comprising about 7½ acres, and will establish its plant at this place. The property is valued at $500,000 and the company has privilege of purchase. Employment will be given to about 500 for initial operations. It is a successor to the Wright-Martin Corporation.

Montana Tractor Co., Tinley Park, Ill., has contracted with the Chamber of Commerce of Oconto, Wis., for the establishment of a new assembling plant to handle the Northwestern and Canadian business. Ground was broken April 15 for a one-story brick and steel building, 150 x 200 ft., at the junction of the Chicago and Northwestern and the Chicago, Milwaukee & St. Paul tracks. The investment will be $150,000. C. H. Haight, vice-president is in charge of operations.

Vreeland Motor Co., 407-9 Elizabeth Avenue, Newark, manufacturer of motor trucks, has completed plans and is taking bids for the erection of its proposed new plant on Colt Street, Irvington. The initial works will comprise a number of one and two-story buildings, 280 x 600 ft., 200 x 250 ft., and 50 x 180 ft., consisting of machine shop, general metal-working department, assembling works, etc. E. E .Vreeland is president; John T. Simpson, Essex Building, is architect. The plant is estimated to cost about $350,000.

General Motors Corporation, 29 West Forty-second Street, New York, with headquarters at Detroit, has acquired the plant of the Doylestown Agricultural Co., Main and Franklin streets, Doylestown, Pa., manufacturer of agricultural implements and machinery, which it will operate for similar production, including tractors, primarily for export. Options on adjoining property have been secured and plans for the erection of an addition for the manufacture of automobiles and farm machinery are contemplated.

Simms Motor Co., Atlanta, Ga., has been incorporated with a capital stock of $2,500,000. A site of seven acres has been acquired and a plant with a daily capacity of 100 cars will be built. The officers are: President Thomas H. Marr, formerly general manager Edward Valve Co., Chicago; vice-president, Jackson H. Simms, formerly of the American Locomotive Co.; vice-president and chief engineer, E. W. Van Duzen, formerly with the Pullman, Columbia, Mitchell-Lewis, Reo and other motor car manufacurers.

Moreland Motor Truck Co., Los Angeles, is planning for the early occupancy of its new plant at Burbank, Cal., which has been in course of construction for some months. The present works will be removed to the new location and a large quantity of additional machinery installed. The new site totals about 27 acres and the initial plant will provide a manufacturing space of about 136,000 sq. ft. The entire project is estimated to cost about $2,000,000.

Plans are now complete for the additions to the Pontiac plant of the truck division of the General Motors Corporation, which will double the capacity of the plant and bring the annual schedule up to 20,000. Additional factory units will be erected with a total floor space of 160,000 sq. ft. A machine shop, railroad sidings, shipping docks, and test houses are among the new facilities to be provided.

Larchmont Motors Corp., a Delaware corporation, has been organized to build cars from the design of Joseph Anglada, probably in the vicinity of Newark, N. J. Two types of cars will be manufactured, a six-cylinder model to sell for about $1,850, an da four-cylinder for export. Assembling on a limited scale will get under way by July 1, and a production of 12,000 for 1921 is planned. Later, trucks will be built in ¾ and ½ ton sizes. Walter H. Shimpf, Newark; George O. Starr and Arthur W. Baldwin, East Orange, N. J., are the incorporators.

Harley-Davidson Motor Co., Milwaukee, will erect a new transformer building, 30 x 55 ft., costing about $35,000 with equipment. A six-story extension is nearing completion and new equipment is being purchased. When the addition is ready for occupancy, the present No. 5 factory at Clinton and Oregon streets will be moved to the main works at Thirty-eighth and Chestnut streets. The Clinton Street shop, which is owned by the Alonzo Pawling estate, is being offered for sale or rent.

Huckabee Tractor Company of Texarkan will move its plant and head offices to Jonesboro, Ark., it was announced recently by T. J. Parker, secretary of the Jonesboro Chamber of Commerce. The tractor company is capitalized at $35,000 and expects to be ready to deliver tractors to purchaser in ninety days. The plant will be located on a plot of 25 acres near Jonesboro.

Garford Motor Truck Co., 427 West Forty-second street, New York, has completed plans and will soon call for bids for a new eight-story, reinforced-concrete building, 118 x 200 ft., at Bridge Plaza and South James street, Long Island City, to cost about $1,000,000, with equipment. McAvoy, Smith & McAvoy, Bridge Plaza, Long Island Cty, are the architects.

Superior Tractor Co., Cleveland, has purchased a 20-acre site at St. Clair, Avenue and East 200th Street on which it will erect a plant shortly for the manufacture of a four-wheel drive tractor. Among those interested are W. D. Sayle of the Cleveland Punch & Shear Co., E. A. Noll of the National Tool Co., and J. C. Lincoln, Lincoln Electric Co.

Haynes Automobile Co., Kokomo, Ind., at the annual meeting declared a stock dividend of 60 per cent and it was voted to build a malleable iron foundry to cost $250,000 and have an output of 20 tons of metal a day. It will also build a plant to manufacture the Little Six Haynes automobile and a factory in which to manufacture the bodies.

Commerce Motor Car Co., Detroit, will erect a branch factory in Guelph, Ont., work on which will start immediately. It will have an initial capacity of 6000 trucks a year. Officers of the Canadian company are W. R. Parker, president; E. M. Baker, vice-president; H. Westeby, secretary and treasurer, and Charles L. Granger, production manager.

H. H. Franklin Mfg. Co., 302 South Geddes Street, Syracuse, N. Y., manufacturer of automobiles, has awarded a contract to Reidpath & Son, Builders' Exchange, Buffalo, for a seven-story addition, 200 x 320 ft., to cost about $900,000, including equipment. The company has arranged for a preferred stock issue totaling $1,000,000.

Thomart Motor Co. has been organized by Akron, Ohio, men and will establish a plant for the manufacture of motor trucks. It has acquire the works formerly occupied by the Seneca Chain Co., in Kent, Ohio. W. G. Thompson is president and B. S. Schriber, secretary and treasurer. The capital stock will be $5,000,000.

Stewart Motor Corporation, 93 Dewey Avenue, Buffalo, manufacturer of automobile motors, has increased its capital stock from $1,000,000 to $2,500,000. It is planning for increased production to practically double the output the past year, which totaled close to $6,000,000 in valuation. T. R. Lippard is president.

Southern Automobile Manufacturing Co., Memphis, Tenn., has broken ground for the first of its factory buildings. This is to be the main building, 350 x 100, two stories high. The first models of the new cars, which are being assembled i nlocal shops, are expected to be completed by June 10.

Fulton Motors Corporation, 34 Pine Street, New York, recently organized to take over the property and assets of the Fulton Motor Truck Co., with plant at Farmingdale, L. I., has been incorporated in Delaware with capital stock of $36,150,000. Garvin Denby is president and general manager.

Pan Motor Co., St. Cloud, Minn., with its former president, S. C. Pandolf, barred from taking part therein, has been conditionally licensed to sell not to exceed 30,000 shares or $2,000,000 of its preferred stock. The proceeds are to be used as manufacturing and working capital.

Schwartz Motor Truck Corporation, 522 Chestnut street, Reading, Pa., manufacturer of automobile trucks, has acquired about five acres at Oakbrook, a suburb of the city, as a site for a new plant. Plans are being prepared for a one and two-story works, to cost $250,000.

Day-Elder Motors Corporation, 20 Colt Street, Irvington, N. J., has awarded contract to the New Jersey Concrete Construction Co., 365 Park Avenue, Newark, for a four-story addition to its motor truck plant, 75 x 262 ft., at Clinton avenue and Twenty-third street.

Chevrolet Motor Co., of California will establish Pacific Northwest headquarters in Portland, Ore. This branch will employ about 150 persons, and will handle all the company's northwest business, said to amount to $15,000,000 to $20,000,000 a year.

Preferred Motor Co., will locate at Louisville, Ky., where a large plant will be built. The company will manufacture cars and trucks and expects to turn out 3,000 cars the first year, and 10,000 a year within three years. The cars are priced from $1,200 to $1,400.

British & American Motors, Ltd., Toronton, has been incorporated with a capital stock of $300,000 by George E. McCann, 49 Wellington

Street East; Francis A. Hammons, James O. Buckley and others to manufacture automobiles, motors, engines, tools, etc.

Leonard Tractor Co., Gary, Ind., manufacturer of motor tractors, will soon call for bids for the erection of a one-story plant, 100 x 250 ft., on Griffith street, to cost about $100,000 including equipment. William Leonard, 524 Broadway, is president.

Kelsey Motor Co., 810 Broad Street, Newark, has been incorporated with a capital stock of $2,000,000 by Ernest B. Slade and Edward J. Churchill, Newark; and C. W. Kelsey, Short Hills, N. J., to manufacture light automobiles.

Oneida Motor Truck Co., of Green Bay, Wis., a Wisconsin corporation with $600,000 capital, will reincorporate in Delaware with an authorized capitalization of $7,500,000, consisting of 50,000 shares of preferred at $100 per share.

Red Diamond Motors Co., Atlanta National Bank Building, Atlanta, Ga., has been organized and is contemplating the establishment of an assembling plant. Prices are wanted on machinery. W. H. Seabrook is president.

Emerson-Brantingham Co., Rockford, Ill., manufacturer of agricultural implements, is having plans prepared for a one-story addition, 80 x 250 ft., to its foundry, estimated to cost with equipment about $175,000.

Ace Motor Corporation, Erie and Sepivah streets, Philadelphia, which is making a four-cylinder motorcycle, has made changes in its executive staff as well as plans for extensions of operations.

International Harvester Co., 606 South Michigan Avenue, Chicago, has let contract for the construction of a one-story tractor assembling plant at 2600 West Thirty-first street, to cost $237,000.

Willys-Overland Co., Toledo, O., will issue $20,000,000 of the recently authorized $25,000,000 common stock of $25 par value. The funds are to be used as working capital at the Toledo plant.

Gearless Tractor Co., Atlantic City, N. J., has been incorporated at $3,000,000 by Chester L. Maxwell, Frank McCaulley and Theodore Thompson, to manufacture motor-driven tractors, parts, etc.

Stockton Tractor Co. has been incorporated at San Francisco, Cal., with a capital of $600,000. No information is available as to the type of machine to be produced.

Saurer Motor Co., Plainfield, N. J., manufacturer of motor trucks, has filed notice of change of name to the International Plainfield Motor Co.

International Motor Truck Co., West Front Street, Plainfield, N. J., has arranged for an increase in its capital stock, to aggregate about $7,000,000.

Shelburne Motor Co., Oklahoma City, Okla., will equip a $150,000 plant for the manufacture of motors.

Mutual Truck Co., Sullivan, Ind., has increased its capital from $500,000 to $5,000,000.

Parts Makers

Klaxon Co., 194 Wright Street, Newark, N. J., manufacturer of automobile horns, has abandoned plans temporarily for the construction of a new plant estimated to cost about $1,000,000, owing to present building costs. To allow for necessary increased production before the new plant is erected, the company has arranged to occupy two of the main buildings at the works of the General Motors Corporation, Grove Street, Bloomfield, N. J., formerly the plant of the International Arms & Fuze Co. The structure will provide about 260,000 sq. ft. of manufacturing space and considerable equipment from the Wright Street works will be removed to this location. The present plant ultimately will be closed. Duncan A. McConnell is president.

Universal Motor Co., Oshkosh, Wis., manufacturer of gas engines and self-contained electro-generating units for farms and other isolated installations has purchased a site, 300 ft. sq., at Fifteenth and South Main streets, for a new machine shop to supplant the present plant on Ceape street. The floor space will be increased from 12,000 to 90,000 sq ft. by the erection of new buildings. The Universal Foundry Co., which is related to the Universal Motor Co., is building an addition providing for a second cupola and more molding floor space.

Grohman Motor Mfg. Co., East Greenville, Pa., incorporated early in the year to manufacture four-cylinder motors for auto trucks and tractors, is planning to start operations soon in its first building. The company has taken over the property formerly occupied by John S. Derr & Son. The initial plant will have a capacity of about six motors a day, and it is proposed to build an extension in the near future. The company will have castings made at the Reading Steel Casting Co., Reading, and the Freed Heater Co., Collegeville, Pa.

Hayes Wheel Co. is making additions to its hub plant, located at Albion, Mich., which will increase its capacity from 15,000 to 25,000 hubs per day. To show the growth of the Hayes Wheel Company in the past eleven years the following figures are cited as to the number of wheels turned out, 1909, 81,416; 1910, 145,660; 1911, 299,576; 1912, 322,599; 1913, 333,523; 1914, 844,608; 1915, 1,723,490; 1916, 2,732,264; 1917, 3,571,640; 1918 (war period), 2,005,215; 1919, 4,229,098.

Medina Machine Co., Medina, Ohio, has been reorganized as the Medina Mfg. Co., and the capital stock increased from $75,000 to $1,000,000. The company plans extensions which will more than double its present capacity and in addition to its other products will manufacture spot lights for automobiles. W. E. Griesinger is president; R. D. Fildes, general manager, and J. E. Thatcher, secretary. The officers are the same as under the old organization.

Wohlrab Gear Co., Racine, Wis., manufacturer of gears and pinions, has purchased the plant of the Schartow Mfg. Co., 1226 Frederick Street, Racine, which is moving its hardware specialty works to South Milwaukee, Wis. The Wohlrab company will make alterations and intends to add considerable tool and other equipment to effect an increase of about 200 per cent in its production of automotive specialties and parts.

Simms Magneto Co., North Arlington Avenue, East Orange, N. J., manufacturer of magnetos and ignition systems, has awarded a contract to the American Concrete-Steel Co., 27 Clinton Street, Newark, for a two-story addition, comprising two additional stories, to its present plant, 177 x 231 ft., with extension, L-shaped 67 x 153 ft., to cost about $385,000, including equipment.

Moto-Meter Company, Inc., together with Harrison H. Boyce, have filed suit in the United States District Court, Northern District of Ohio, against the F. B. Stearns Company, claiming the latter infringes the Moto-Meter Patent No. 1,275,654 which was granted to Boyce and filed in the patent office during 1912, through continued used of a device called the "motor eye."

Spicer Mfg. Co., South Plainfield, N. J., manufacturer of automobile parts, has acquired control of the Salisbury Wheel & Axle Co., Jamestown, N. Y. A short time ago the Spicer company acquired the Sheldon Axle & Spring Co., Wilkes-Barre, Pa., and the Parish Mfg. Co., Reading Pa., with branch at Detroit, manufacturing a similar line of products.

Body Builders

Ohio Body & Blower Co., Cleveland, Ohio, has completed a new five-story plant. Another five-story unit containing 90,000 feet of floor space, which will be ready for occupancy by June or July, is now in the process of construction. This plant will be used for the manufacture of closed automobile bodies. The unit recently completed, into which the company has just moved, will enable an increased production of open bodies to fifty or sixty a day, while this number will be increased by eight to ten a day when the closed body shop gets into operation this summer.

Locke & Co., body builders of New York, in behalf of themselves and 20 other members of the Automobile Body Manufacturers and Allied Trades of N. Y., applied to the courts for an injunction to restrain the officers of the United Automobile, Aircraft and Vehicle Workers Union of America from interfering with the business of their employers and non-union workers by picketing in connection with their strike for higher wages and shorter hours, but the application was denied by the court which held that nothing illegal had been proven.

McCord Mfg. Co., Chicago and Detroit, which recently acquired the Racine Mfg. Co., Racine, Wis., manufacturer of high grade automobile bodies, will erect a four-story brick and mill addition, 80 x 120 ft., costing about $150,000, for sheet metal working, forgnig, etc. The architect is Edmund B. Funston, Racine. C. F. Brand is manager of the Racine works.

Stratford Body Co., Stratford, Conn., specializing in the manufacture of motor bus bodies, is planning for the erection of an addition to double approximately the present output, construction to start within the next few months. Plans are being prepared for the installation of equipment at its power plant to change from steam to electric operation.

Bain Wagon Co., Kenosha, Wis., has increased its authorized capital stock from $400,000 to $1,200,000, the new issue being absorbed by present stockholders. It is reported that the company is preparing to enter the motor truck and trailer industry, but confirmation is lacking. George A. Yule is president.

Yellow Cab Co. and the Walden W. Shaw Livery Co. have leased a one-story manufacturing plant, 415 x 500 ft., Dickens Avenue and Menard Street, Chicago, for the manufacture of automobile cab and truck bodies. The plant will produce eight cabs and six to ten trucks a day.

Mullins Body Corp., Salem, Ohio, earnings for the first quarter of this year amounted to $283.000. Earnings for the month of March were $132,000 at the rate of $15 a share before taxes, but after preferred dividends, upon the common stock.

Detroit Weatherproof Body Co., Pontiac, Mich., manufacturer of automobile bodies, has awarded a contract to Grotton Brothers, Lansing Mich., for the erection of a three-story and basement plant, 70 x 150 ft., at Corunna, Mich.

Maxwell Motor Co., Dayton, will operate its Leo Street works for the manufacture of automobile bodies. It has been used for making axles and motors. The Third Street factory will make closed bodies exclusively.

American Auto Top Co., Delphi, Ind., has been incorporated with $200,000 capital stock to manufacture automobile tops and accessories. The directors are James A. Shirk, James C. Smock and Leander D. Boyd.

WANTS

Wanted:—West Tire Setter No. 3, in good condition. A. E. Stevens & Co., Portland, Me.

For Sale:—Wheelwright and auto repair business, established over 25 years. Very conveniently located. Obliged to sell because of death of former owner. For particulars, address G. H. Blume, Railroad Ave., New Rochelle, N. Y.

PATENTS

Patents—H. W. T. Jenner, patent attorney and mechanical expert, 622 F St., Washington, D. C. Established 1883. I make an examination and report if a patent can be had and exactly what it will cost. Send for circular.

Index To Advertisers

STATEMENT OF THE OWNERSHIP, MANAGEMENT, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, of AUTOMOTIVE MANUFACTURER, published monthly at New York, N. Y., for April 1, 1920.

State of New York,
County of New York, ss.

Before me, a Notary Public in and for the state and county aforesaid, personally appeared G. A. Tanner, who, having been duly sworn according to law, deposes and says that he is the Business Manager of The Automotive Manufacturer, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business manager are:
Publisher: Trade News Publishing Co., 25 Elm St., New York, N.Y.
Editor: Morris A. Hall, 25 Elm St., New York, N. Y.
Managing Editor: Morris A. Hall, 25 Elm St., New York, N. Y.
Business Manager: G. A. Tanner, 25 Elm St., New York, N. Y.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.)
Trade News Publishing Co., 25 Elm St., New York, N. Y.
G. A. Tanner, 25 Elm St., New York, N. Y.
Paul Morse Richards, 25 Elm St., New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock bonds, or other securities than as so stated by him.

G. A. TANNER, Business Manager.

Sworn to and subscribed before me this 12th day of April, 1920.
(SEAL)
JOSEPH R. FRITH,
Notary Public, New York County, No. 122.
My commission expires March 30, 1922)

The Automotive Manufacturer

The Hub of Automotive Engineering

BODY BUILDING - AUTOMOTIVE PARTS - ALLIED INDUSTRIES

Vol. LXII, No. 3. NEW YORK, JUNE, 1920 $2.00 Per Year Issued Monthly

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The Automotive Manufacturer
The Hub — A CONSOLIDATION OF — AUTOMOTIVE ENGINEERING

Vol. LXII NEW YORK, JUNE, 1920 No. 3

Many New Ideas in Ingersoll-Rand P-R Oil Engine

New Type of Engine Shows Many Novel Features, and Produces High Unit Power Output and Low Fuel Consumption, as Well as Remarkably Slow Speed

WHAT may be termed a new type of engine has been produced by the Ingersoll-Rand Co., New York, in the P-R line. These must be considered as a new type because they are heavy oil engines, yet are not of the Diesel type on the one hand, nor of the semi-Diesel or hot bulb type on the other, into which two classes the majority of oil engines are classed. The P-R differs in that it is of the low compression self-igniting form, that is, it is self-igniting just the same as the Diesel, the heat of compression being used to ignite the fuel, but a low compression is used similar to the usual hot bulb form. It is not of this type however, and no hot plate or other form of hot spot is utilized. The shape of the combustion chamber the arrangement of the spray nozzles and the early injection of fuel combine to produce this unusual result.

It is unusual to the further extent that the solid system of fuel injection is used, that is the oil is pumped into the cylinders without the use of an air spray. Generally speaking, this method is not considered efficient, but if the operating and test data obtained from engines of this new make are any criterion, the Ingersoll-Rand engineers have something entirely new, different, and most desirable.

The engine, shown in outline in Fig. 1 which goes with the table, and in full view in Figs. 2 and 3, is made in a fair range ot the smaller sizes, shortly to be increased by some larger units. It is made for stationary work and marine service. In stationary form, it can be adapted to any power plant or manufacturing service, especially for the operation of electric generators in parallel.

For marine use, there are three sizes, as the table shows. As this description will cover mainly the marine forms, these may be summarized. They are the 11 x 15 rated at 220 h. p. at 300 r. p. m., the 13 x 19 rated at 300 h. p. at 250 r. p. m., and the 17 x 24 rated at 500 at 165. All

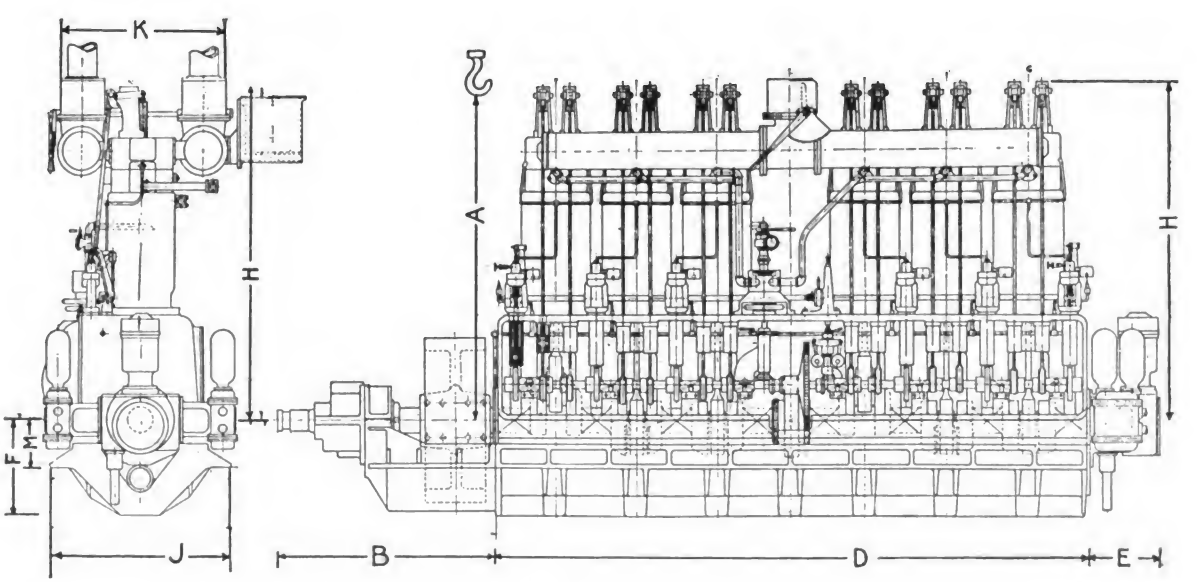


Fig. 1. Diagram of P-R marine oil engine showing (with table) principal dimensions

have six vertical cylinders in line, with a single six-throw crankshaft in the smaller forms and two three-throw units bolted together to form a single shaft in the largest sizes

As a marine engine, the P-R is directly reversible and the change from full speed ahead to full spead astern can be made in seven seconds. This is accomplished by interchanging the functions of the two sets of valves, so that the inlets act as exhausts and the exhausts as inlets. The air starting cam simply admits the starting air to the cylinder whose crank is in the proper position for turning in the direction desired. Very little air is used, and a pressure of 175 lbs. is sufficient for the starting or reversing The engines are of the slow speed type, as will have been noted in the rating speeds, just given. However, they can be run somewhat faster, and very much slower. In fact, they have a remarkable speed range. The 220 h. p. unit can be throttled down to 85 r. p. m. all cylinders firing, and in a test of one of this size for the British Guiana Government, ran for two hours at this very low speed. In the same test, with only three cylinders firing the speed was reduced to 60 revolutions. In this particular test the engine developed 200 h. p. on 88 lbs. of fuel per hour, or at the ate of .44 lbs. per b. h. p.-hr., this being at 300 r. p. m. Subsequently, it was run for three hours with a different injection setting, 32 deg. before top dead center instead of 33, and the consumption reduced to .43 lbs. per b. h. p.-hr. The higher figure (.44 lbs.) is guaranteed by the manufacturer at the rating speed, and also at three-quarters of this speed or 225 r. p. m. At half load and even slower speed, the difference is but a few hundredths of a pound more. The fuel used in the test mentioned above was locally obtained fuel oil of 86½ specific gravity at 65 deg. F. The engine has developed 318 b. h. p. at the rating speed subsequently, and the rating increased as a result to the 220 figure given.

In another respect the engine is out of the ordinary, that is it has remarkable accesibility. Stay rods carry the weight of the cylinders, heads and other parts to the bed plate, so that large working doors can be provided. On the camshaft side, the entire side of the shaft housing is removable in one piece. Fig. 5 illustrates this clearly showing as it does that side of the engine with the plate off. These features permit of making quick repairs, an important factor in keeping down operating costs.

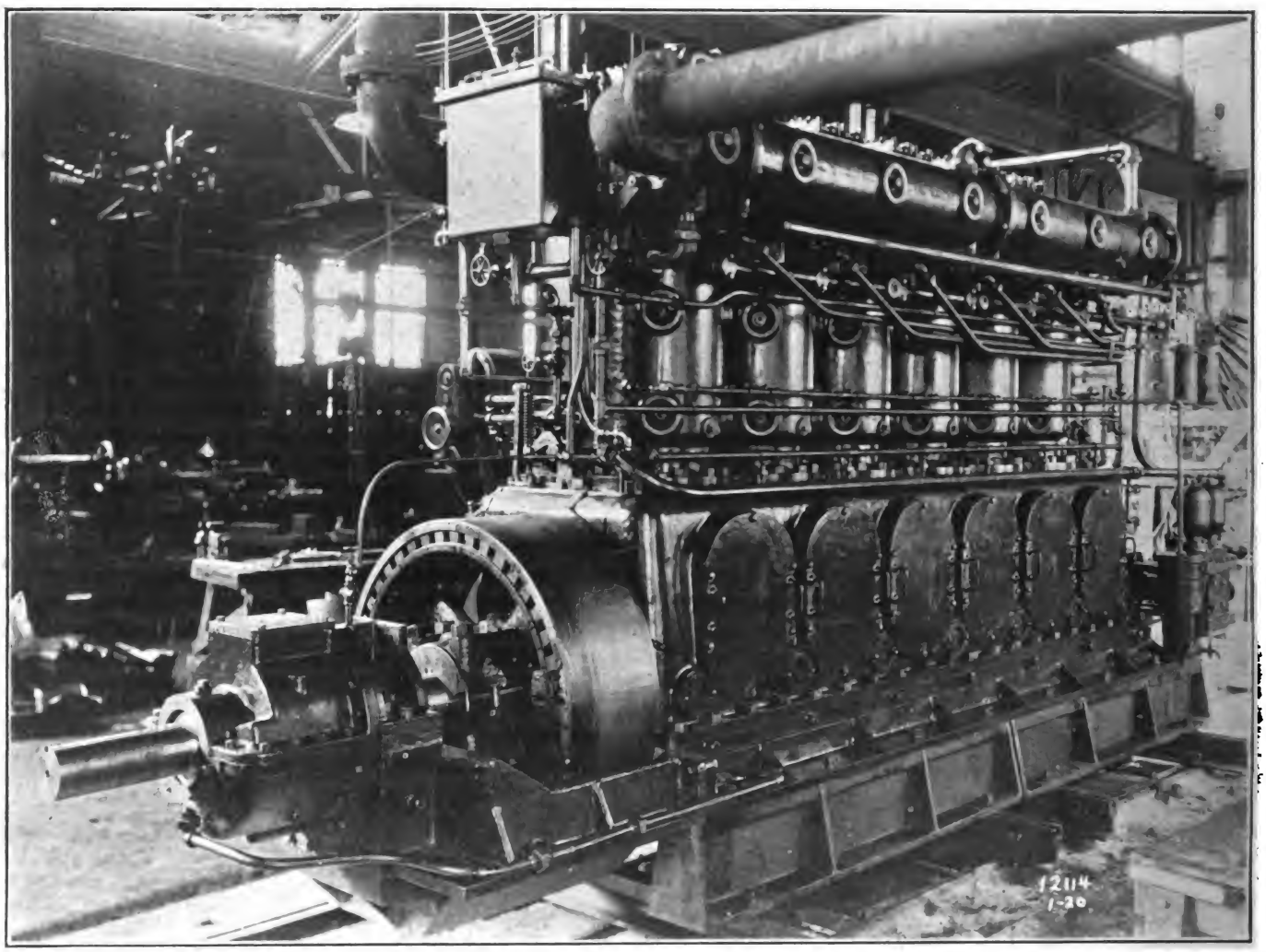


Fig. 2. Right side view of P-R oil engine showing flywheel, Kingsbury thrust bearing, exhaust manifold and other details

The Cycle and Its Advantages

There are three points of advantage in the low compression cycle which should be noted.

1—The mean effective pressure which is proportional to the net work developed in the engine cylinder for the same brake horse power of engine need be only 85 per cent. of that of the high compression cycle. This is due to the higher mechanical efficiency. There is no air compressor to be driven with the P-R oil engine and the friction losses are lower.

2—The mean pressure of compression, which is proportional to the work done in the engine cylinder during the compression stroke, is approximately half that of the the high compression cycle. While it is true that this work is not lost, being returned to the piston during the expansion stroke, nevertheless the performing of this extra work of compression by the piston and the return to the piston of an equal amount of excess work during the expansion stroke, represents more wear on piston, cylinder and bearings.

For the same brake horse power the low compression cycle subjects the engine to approximately thirty per cent. less wear. With parts of equal dimensions they will wear considerably longer—they will require less attention.

3—The maximum pressure and temperature in the cylinder are considerably lower, so that all of the parts that are designed for strength, stiffness or temperature stresses may be constructed much more conservatively.

The intake valve is opened mechanically and the piston moves downward on the suction stroke, drawing in a full charge of pure air.

The intake valve is closed by the valve spring and the piston returns, compressing the air from the cylinder into the combustion chamber to a pressure of approximately 200 pounds per square inch. Injection of the fuel starts near the end of the stroke and is completed before the piston has reached the end of its travel. The system of fuel injection is such that ignition is automatic and perfect combustion occurs.

Working stroke combustion at constant volume occurs almost exactly at dead center, and the pressure rises from 200 to approximately 400 pounds and the piston moves downward on the working stroke.

Near the end of the working stroke, the exhaust valve is opened mechanically, the pressure drops, and the piston returns, expelling the burnt charge.

The P-R engine is free from hot caps, uncooled apron castings, hot surfaces or igniting points except that an electric igniter is used only for the first few ignitions when starting the engine from a cold condition. The absence of hot caps or hot surfaces of any kind in the engine is of great advantage in eliminating over-heating troubles at high loads and under-cooling troubles at light loads. The absense of highly heated parts permits a full charge of air to be drawn in instead of being heated, expanded and reduced in quantity. This is one of the reasons for the high power attained by this type of engine for a given piston displacement. The cracking and burning out of the hot caps is elminated. The operator is enabled to attend to the engine properly when it is cooled at all points. The absence of starting torches reduces the fire hazard and permits of a clean engine room.

The statement is often made that since the fuel cost of of an oil engine is so low, a gain in economy is a small

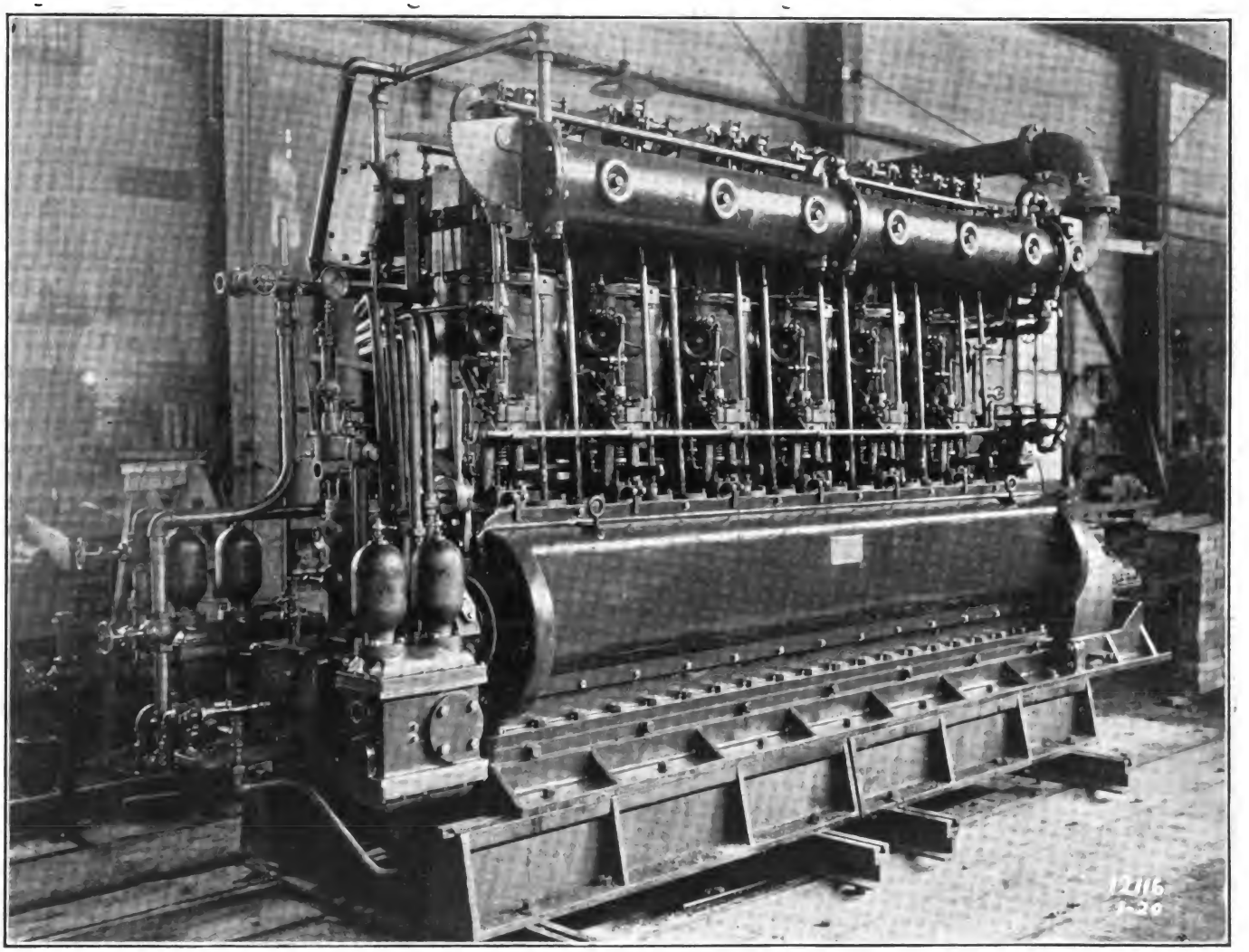


Fig. 3. Left or port side, showing attached air compressor, bilge pump, circulating pump, valve gear and other details

factor, that dependability is of prime importance. Many fail to realize that dependability is intimately related to high economy. Every heat unit in the fuel that is not transformed into useful work must be carried away through the walls of the combustion chamber or through the cylinder walls to the jacket water or must be carried

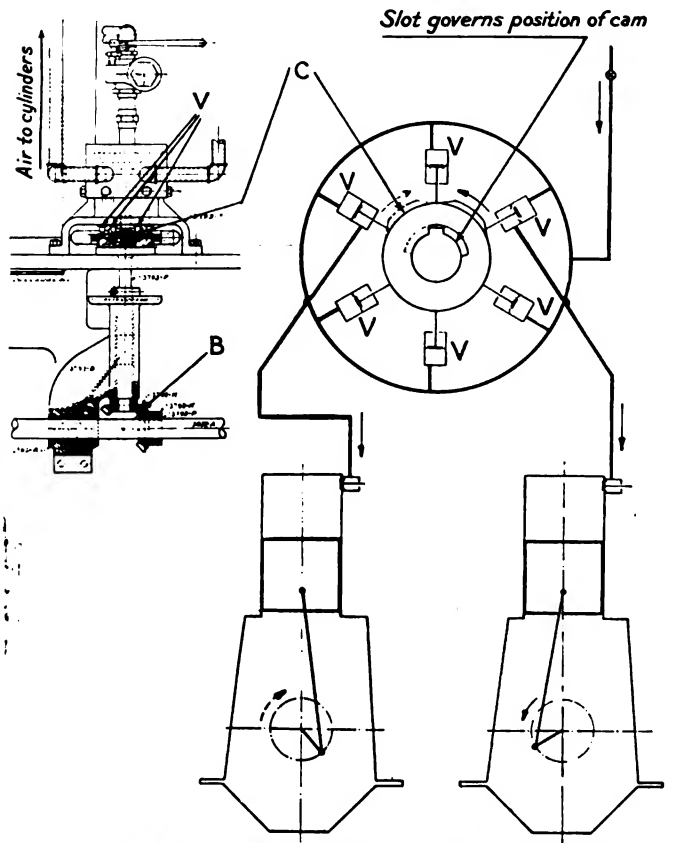


Fig. 4. Diagram indicating air starting mechanism, its operation and detail of distributor cam

past the exhaust valve and exhaust valve seat during exhaust, or must disappear as friction in bearings or cylinder at expense in upkeep and durability of the engine. In an inefficient engine, not only is a large percentage of the fuel wasted, but in getting rid of the waste heat, serious deterioration of the engine results. The waste oil must be paid for in the fuel bill, paid for in additional lubricating oil to preserve the oil film on the over-heated piston and cylinder walls, paid for in additional cooling water to dissipate the waste heat, and paid for in engine upkeep. High fuel economy means low fuel cost, low lubrication cost of cooling water, low cost of repairs, long life of engine.

Starting Method and Details

A great advantage of the Ingersoll-Rand engine is the ease with which it can be operated. The method by which starting, stopping or reversing is effected is of such interest that it is explained here in some detail.

The valve timing and action of the fuel pump are de- starting, stopping or reversing is effected is of such in- the dead center, so that no matter which direction the engine rotates the valve timing will be identical with the exception that the exhaust valve will become the intake valve and the intake valve will become the exhaust valve. It will be noted that a water-cooled manifold is used on either side of the engine, so that when going in one direction the port manifold is the exhaust and when going in the other direction, the starboard manifold takes care of the exhaust gases. It is only necessary to run a separate pipe from each manifold. When the engine is running in one direction the air is taken into one pipe and the exhaust is discharged through the other, and when the engine is reversed the direction of flow is likewise reversed. On account of the completeness of combustion, the exhaust pipe remains clean, so that no difficulty is therefore experienced from using the exhaust pipe as an air intake.

The engine is started by compressed air through the assistance of a distributor, which consists of six air valves (V), one for each of the cylinders (see Fig. 7). Below these air valves is a cam (C) which is operated by a beveled gear (B) from the side shaft. When the air is turned on the six valves are driven down by the air against the action of springs and are all closed, with the exception of one valve which strikes on top of the cam. This valve being held open by the cam, permits the air to pass to the cylinder through the controls. The engine turns in a given direction and the cam likewise turns, opening each valve in succession. When it is desired to reverse the engine, it is first stopped, the cam (C) is moved to its opposite position and the air valve opened. The engine then turns in the opposite direction and the cam likewise turns in the opposite direction opening the valves in the reverse order.

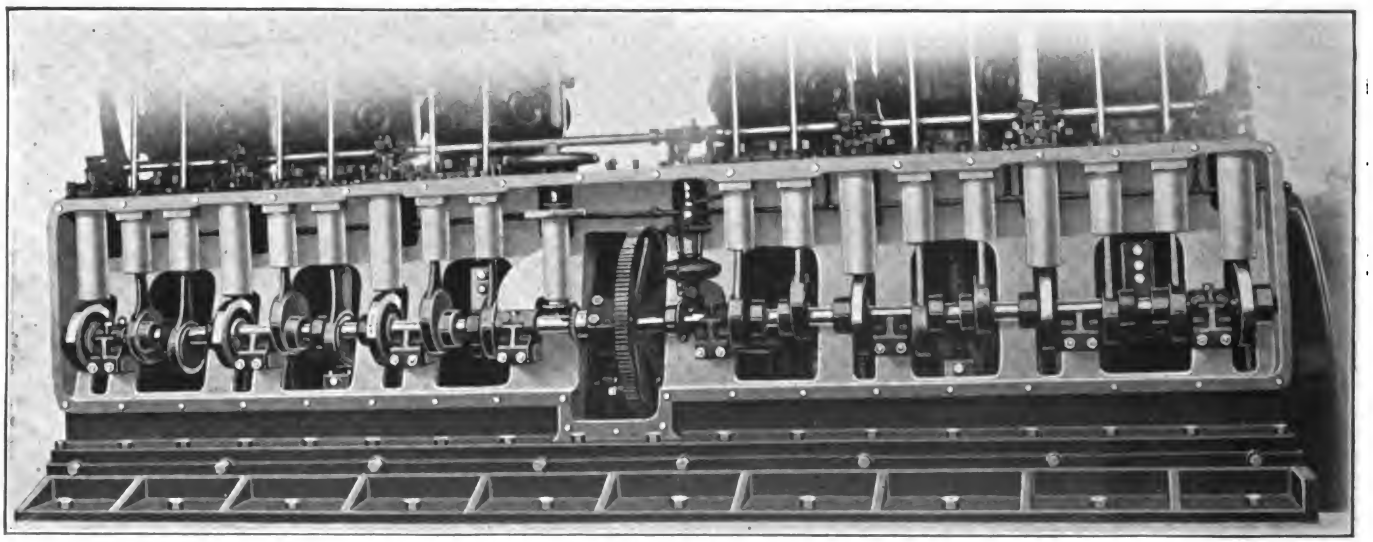


Fig. 5. Operating side with cover removed to show camshaft, drive, bearings, and cam eccentrics

At the same time that the air is admitted the fuel control lever should be thrown to the on position so that as soon as the engine has made a number of revolutions it begins to turn under its power.

The air starting device acts in a manner similar to the self starter of an automobile.

When the engine is absolutely cold the ignition at the start is assisted by means of a small electrical starting element located in the combustion chamber, which is heated to a dull red. This heating element is used only for a few revolutions, and then discontinued. It does not act as a hot point or hot bulb, and after the engine has once been started it could be stopped, the heating element removed, and the engine started again without it. It is provided only for starting when the engine is cold.

To reverse the engine, it is only necessary to cut off the fuel and allow the engine to come to a stop. The hand wheel governing the position of the cam is then shifted so that the pin moves to the opposite end of the stop, and the air and fuel are then turned on.

Details of Construction—Baseplate

The base of the bed plate is of heavy construction and of very simple design. It is cast to form the oil reservoir for the lubricating system. It is strongly reinforced by ribs, while broad flanges give ample bearing on the foundation.

The bearing pedestals for the crankshaft bearings are cast integral with the base, as can be seen from Fig. 6. There are seven bearings for the six-cylinder engine, not including thrust.

The housing which encloses the driving parts and also forms the top half of the oil basin is a heavily ribbed casting with unusual provision for access to the interior. Doors placed at the back directly opposite the crank throws, permit easy inspection or adjustment of the driving parts, while a single cover bolted to the front of the machine and supported on swinging hooks, trolleys and slide rails suspended from the platform gives access to the side shaft, the governor, eccentrics, etc.

The housing is flange-bolted to the bed plate. Working stresses in the housing have been eliminated by the introduction of housing stay bolts or tie rods, which transmit all the working stress from the top of the housing to the bed plate.

Main Bearings

The main bearings of the type P-R oil engines have been designed to insure true alignment, and provide for quick and easy adjustment.

Referring to Fig. 6 it will be noted that the bearing caps, on which there is practically no wear, are bolted securely to the bed plate. The bottom halves of the main bearings are held rigidly sidewise in the bed plate and supported on heavy wedges which are adjustable from the outside of the housing by means of wedge bolts. By shifting the wedges the bottom half of each main bearing may be raised until the shaft is brought in contact with the rigidly held bearing cap, securing perfect alignment. The wedge bolts are then tightened and no further movement is possible. Likewise by the removal of the wedge bolts and wedge any one of the lower main bearings can be removed and renewed without disturbing other parts of the machine—a feature not usually found in machines of this type.

Cylinders and Heads

The cylinders are semi-steel castings, thoroughly water jacketed and liberally supplied with easily "get-at-able" clean-out holes. The water jacket of the cylinder is connected with the water jackets of the heads by outside manifolds in place of jacket to jacket contact. This has permitted the use of metal to metal joints at points of high pressure, prevents leakage, and has eliminated the use of troublesome gaskets and packing. The cylinders are flange bolted by studs to the top of the housing. The cylinder heads consist of two parts, the intermediate head forming the combustion chamber carrying the compressed air starting valve and the starting element, and also the main head containing the fuel injection nozzles, air inlet and exhaust passages and also forming the seats for the inlet

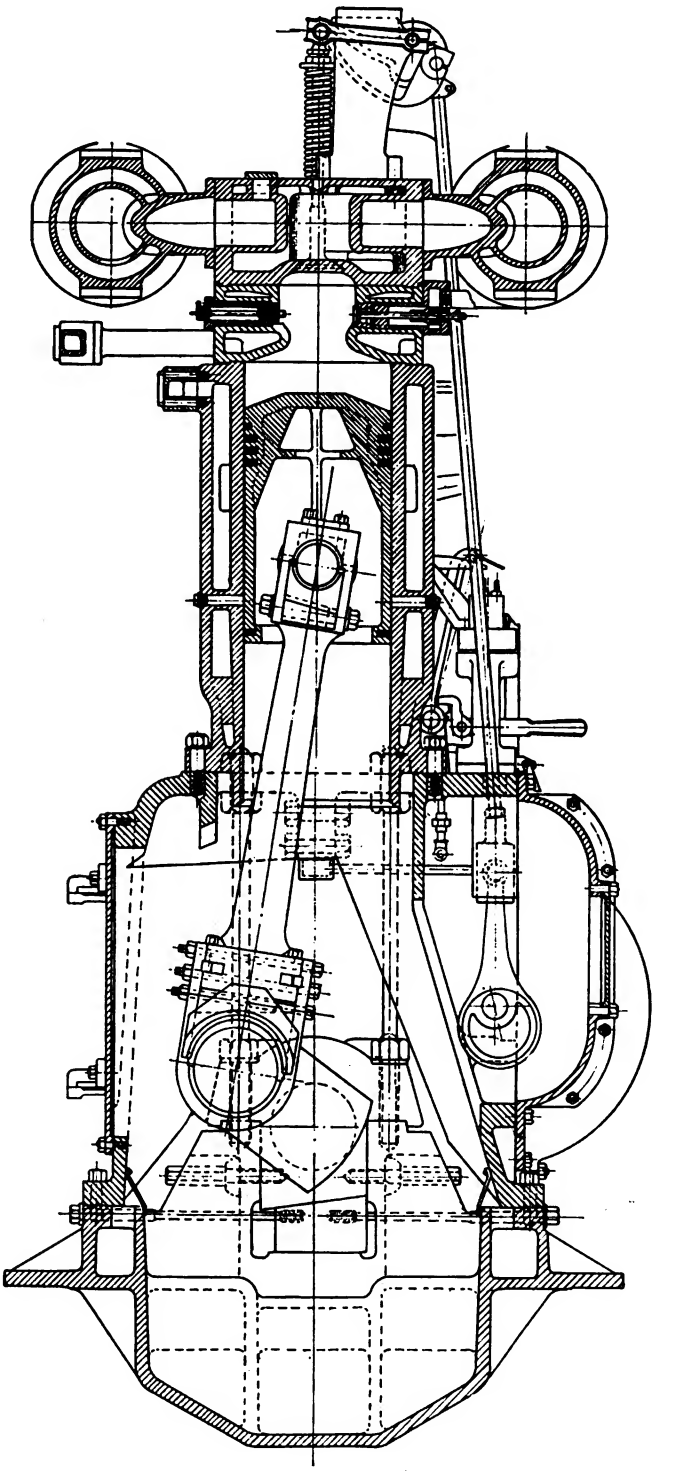


Fig. 6. Vertical cross section of P-R engine, showing general construction

and exhaust valves. The heads are thoroughly water jacketed.

Pistons

The pistons are cast of a special mixture to withstand wear and avoid warping. They are very accurately and closely fitted to the cylinder and fitted with a fire ring at the top, and are packed with a set of beveled rings held in place by beveled segments secured by flat springs. A wiper ring is placed at the bottom of the piston preventing an excess of crankcase oil entering the cylinders or the used cylinder oil returning to the crankcase.

Valves and Valve Motion

The valves which are of the mechanically-operated poppet type are located in the heads and surrounded by liberal water jacketing. The valve motion is of the roller path type, operated by eccentrics mounted on the side shaft as shown in Fig. 5. This makes for quietness and smooth operation. The timing of the valves and the injection of the fuel is obtained from the side shaft through the medium of one pair of spur gears, driven by the cankshaft.

The roller path motion mentioned consists of a floating lever, one end of which rests on the valve stem and the other is attached to the eccentric rod which receives its motion from the eccentric on the side shaft. The end of the floating lever therefore moves up and down with a harmonic motion. The upper surface of the floating lever is curved and rests against a stationary block of slightly smaller radius of curvature. The point of contact between the two pieces changes as the valve opens and shuts, having the effect of uniformly accelerating the motion of the valve. It will be noted that at the moment of opening of the valve, considerable leverage is obtained on account of the point of contact being so close to the valve stem. This means that a minimum of stress is exerted on the push rod and side shaft when opening the valves against the terminal pressure. When the valve is opened slightly, this pressure is destroyed, and the point of contact then recedes, so as to increase the speed of opening of the valve. This is one of the quietest operating valve gears used on internal combustion engines. It will wear for a long time without repair.

Table 1. Dimensions of P-R Marine Oil Engines

Bore and Stroke	B.h.p.	R.p.m.	A ft.	B ft.	D ft.	E in.	F in.	H ft.	J in.	K ft.	M in.
11 x 15	220	300	8 6	5 0	11 2	22	22	6 6	48	4 0	13
13 x 19	300	250	10 0	5 6	14 8	20	30	8 3	49	4 3	14
17 x 24	500	165	12 6	6 6	17 6	25	32	10 0	58	5 3	16

Imports and Exports Keep on Increasing

Someone has said that the United States is now the storehouse of the world. No better proof of this is needed than the figures from month to month of the country's trade. The exports represent the things we have in the way of raw material, partly or wholly manufactured goods, clothing or foodstuffs, which other nations must have, while the imports represent the things which we are able to buy out of our surplus of money or commodities equal to money.

For March, the figures show that imports totalled $483,902,135, and increase of $216,365,846 over March, 1919; while exports amounted to $819,974,128 as compared with $603,141,648 last year. The excess of exports over imports or amount added to our credit, was $336.545,359, which just barely exceeds that of 1919, $335,545,359.

These figures bring the totals for the nine months ending with March, 1920, up to $3,719,182,231 imports, and $6,050,873,395 exports. As a means of comparison, the similar figures for the nine months ending with March 1919, were $2,200,921,983 imports, and $4,985,652,378 exports. These show an excess of exports of $2,784,730,395, while the 1920 figures shown an excess of $2,331,691,164.

In the 1919-1920 fiscal year, March is the record month for both imports and exports.

As the present total trade is in excess of nine billions, the whole commerce for the fiscal year, if the average to date is continued, should exceed thirteen billions. This is but 12 per cent less than the totals for the four years 1910, 1911, 1912 and 1913 combined and the same amount less than five years 1905, 1906, 1907, 1908 and 1909 combined.

Possibilities in Oil From Shales

It is generally admitted that soon it will be necessary to obtain a very large part of our oils from others sources than the present oil wells, and among the possibilities always in mind are the Colorado, Nevada and Utah shales. In Scotland processes have been developed which obtain approximately 40-50 gals. of oil from a ton of shale at a price which enables competition with the oils which flow naturally. Oil does not exist in shale as such, but is present in the form of complex organic compounds called "Kerogen." This material, upon heating in suitable retorts where air is excluded, yields hydrocarbon oil and permanent gases, while the nitrogenous material of the shale breaks down into ammonia and organic bodies. The operation of shale retorts is fairly well standardized so that what can be done becomes largely a question of economics. The temperatures reach a bright red heat at the base of the retorts and as the shale must remain in the retort for a long while, a large investment in equipment is required to handle a daily tonnage great enough to make the operation pay. The Scottish shales average about 23 gallons of oil per ton, which is lower than the values obtained with western shales, but their yield of ammonium sulphate is much higher and averages between 60 and 70 pounds per ton of shale treated. The maximum amount of ammonia is obtained by heating the shale to incandescence and then introducing steam which dissociates in the presence of a fixed carbon that has been formed in the process of heating. This liberates free hydrogen, which combines with the nitrogen, forming ammonia. In the case of our western shales it may therefore prove advantageous to operate the retorts solely with reference to the oil recovery and fuel economy.

Theoretically the products now obtained from crude petroleum and coal tar may also be recovered from shale oil operations, but it will doubtless be some time before the technology of shale treatment has been brought to the point where it will be profitable to make so wide a variety of products as is now separated from petroleum. After all, the production of oil from shale is a manufacturing proposition requiring large capital and abundant engineering and technical skill rather than the kind of manufacturing operation involving a number of intricate chemical processes and the corresponding highly organized research staff.

Ideas From Abroad for Coach Builders

More Body Ideas from the Other Side, Notably on Enclosed Forms, of the Limousine, Sedan and Brougham Types. Trimming and Interior Treatment

CONTINUING the detailed description of the newer enclosed bodies as given in the April issue, this issue will cover the balance of the limousines and landaulettes, and the brougham types, the smaller of which are sometimes called brougham coupes on the other side. To the high class workman, whether on the board or at the bench, the enclosed and semi-enclosed forms have the greatest attraction because their prices permit of finer, more artistic treatment from the laying down of the first lines to the actual trimming and painting of the finished work, and including all the steps in between. It is in this possible that a study of some of these finer examples may bring about a compromise form, which may be said to be truly American in that it can be turned out quickly and in quantities, and yet have beautiful lines, and in general, an artistic appearance.

Among the enclosed body forms at this year's big displays, there were a number of matters of interest to the body builder, thus, there was a noticeable increase in the use of aluminum. This has been brought about in part by the war, during which all the plants in the world producion this metal were enlarged many times in capacity.

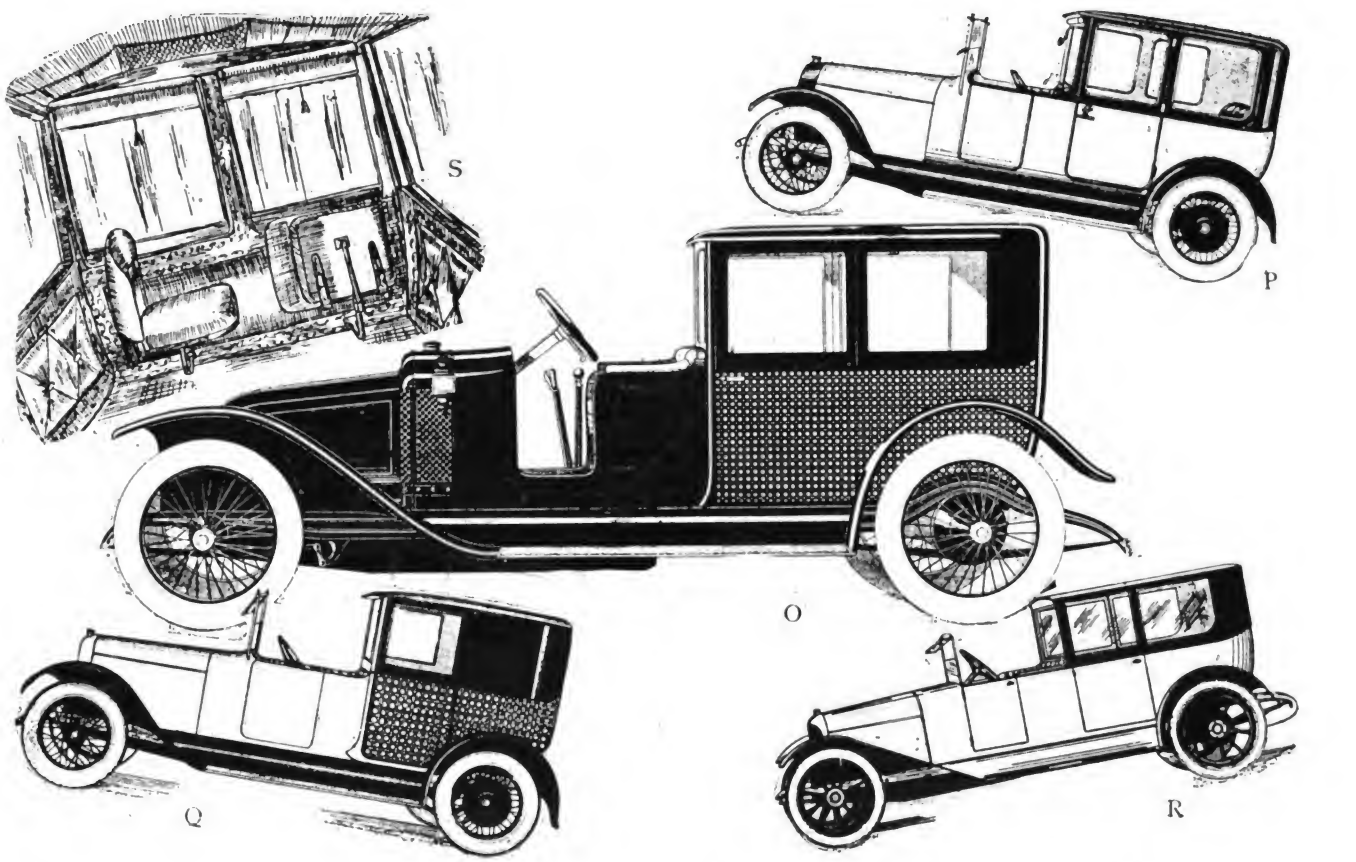


Fig. 5. Representative foreign enclosed bodies in limousines and brougham-limousines. At O, Renault brougham-limousine with caned panels; P, brougham-coupe by D'Iteren on Delaunay Belleville chassis; Q, Bugatti brougham coupe with well executed cane panels; R, Zedel, a typical Paris single limousine; S, limousine interior by Messrs. Caffyns, Ltd.

class of work that the older British firms and their workmen have delighted (and with delightful results); similarly, the French temperament has proven particularly fitted to this kind and class of work, with equally splendid results. Some of the Dutch and Belgian firms of former coach builders have done particularly well along these lines too.

American improvement has been more generally along the line of speed, and many designs are laid down primarily to evolve a form which can be put through the shops at maximum speeds. One result has been to produce enclosed bodies for the multitude, fitted to even the very lowest priced chassis, but toward the advancement of the body building art, this trend contributes nothing. It is

It has been brought about partly by the development of welding processes and equipment, so that now it is possible to unite the almuinum plates by welding and produce a structure that has few if any real disadvantages. Many body builders never did like the use of aluminum sheets on ash frames, as they claimed the warping of the body due to road inequalities would soon loosen the screws holding the aluminum to the wood, with the result that the body would not hold together very long. Many other body builders never have taken to the all cast aluminum body, as the cost of the pattern was so great as to make this use prohibitive except on very large quantities, while the very expense of the patterns and plates precluded the making

of small changes from time to time, as customers wished. In short the cast aluminum body is an inflexible proposition, not suited to small (and largely, special) production.

Wider and wider doors have been coming in recent years, as body builders have shown that they could be built into the bodies without weakening them. At this year's shows, many cars were shown which had the sole means of entrance by a central door of unusual width. In some of these, the access to the driver's seat was obtained by the application of metal runners to the floor enabling the seats to slide or the near side to lift up, while in others, as space would permit, it was made by a fold-over back to driver's seat. In some, however, the doors were in front and the entrance to the rear seat could only be obtained by lifting up or otherwise manipulating the front near-side seats. Before leaving the subject of seats we may mention the added improvement of the adjustable arm rests that are now fitted to all rear seats of the best designed bodies. This in effect, with well upholstered side elbow pieces, practically converting the seats into comfortable armchairs, providing also the correct pitch is given to the seats, with the necessary inclination and fulness, as seen in the D'Ieteren, Cunard, Hooper, and Cole body work. Some saloons were provided with four doors, two in the middle and two forward; in that way any of the seats could be reached without disturbing the occupants, which for a large car is, in our opinion, decidedly the best. Cabriolets and quarter light landaulettes, with the hood to fold from the back pillar or as in the former, to fold from the front screen pillars, all having large and well proportioned side windows of frameless glass, and easily convertible into an open carriage. While the underlying principle of their construction has not changed, several new devices and ingenious arrangements have of recent date been introduced by which easy folding hoods with little overhang, regular and even creasing of the top fabric, the hood, when down, lying in a line or nearly so with the body. The fine finish that was given to the exposed head fittings was notable, a large number in nickel plate, others in antique bronze and all free from sharp corners and edges likely to catch the hood covering with the centres of joints better arranged, so much so, that in some cases to entirely dispense with spring balance, showed that real progress had been made. This was especially noticeable in the coupes, which ranged in size from the important six-seater Cole cope on a Vauxhall chassis, to the miniature Marlborough coupe to carry two persons inside on the folding top.

The cabriolet landaulet as well as the quarter light landaulet, is popular in the north, and it is doubtful if a finer piece of good solid coach work was to been in the Scottish show than the town landaulet with quarter light on 15 h.p. Fiat by Croall and Croall, York Lane, Edinburgh; the lines of this body as well as the finish were singularly pleasing and well done. That the coupes would be a numerous class was expected, for the vogue this type of car has obtained among the fresh air loving Britisher has been responsible for its development and improvements, so that the coupe in a great variety of designs, with and without removable tops, has become a most popular car. Some very fine specimens were staged from the large and important four-seater Cole coupe on 30 h.p. Daimler to the coupe of the light car section. One of the best examples of a small four-seater was the D-front coupe on 15 Renault by H. D. Cleland, Edinburgh. This was a wonderfully well-designed body with a quarter light at the back part and a nicely rounded front corner, the interior body space affording room for an extra seat on the near side;

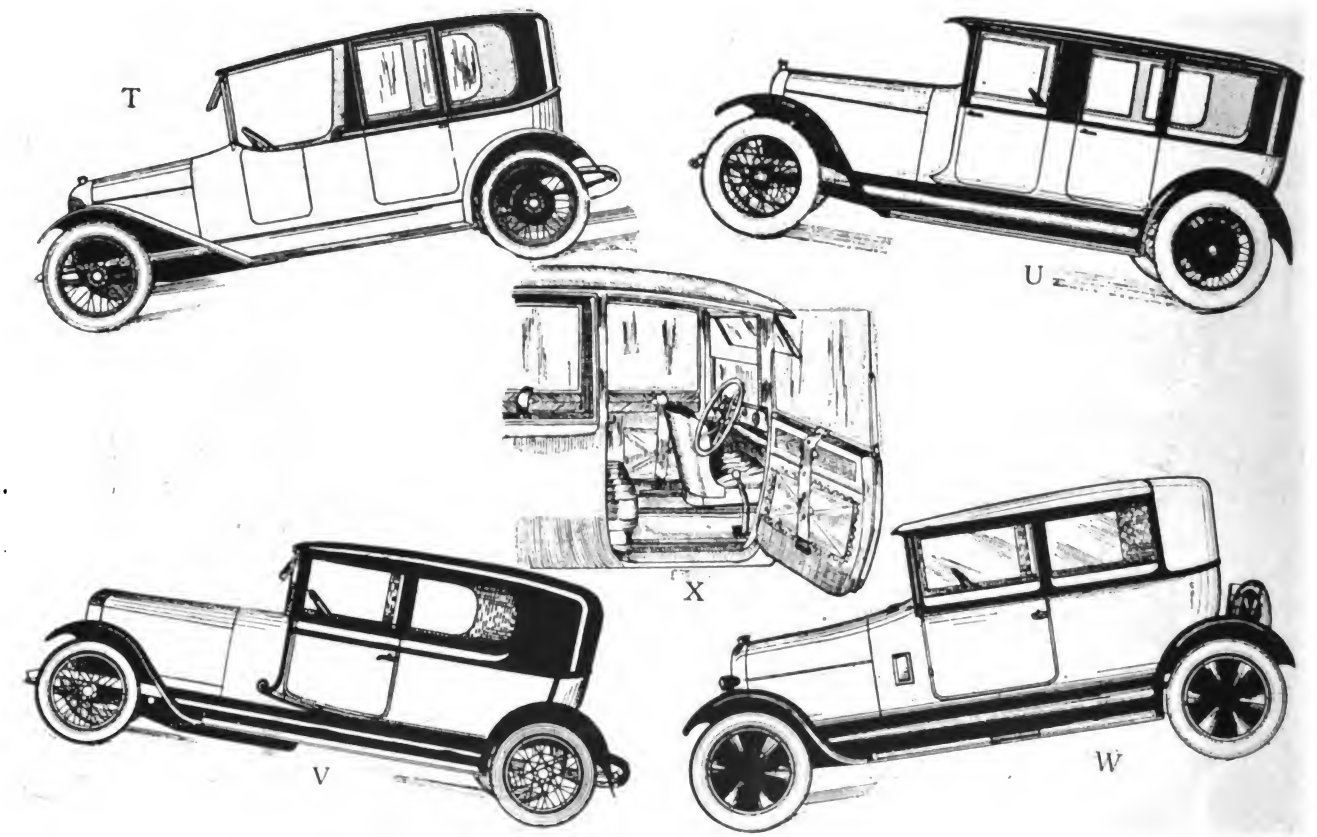


Fig. 6. Typical Saloons, Limousine and Berlin from abroad. At T, Kellner limousine on Lorraine-Dietrich chassis; U, Labourdette limousine, which has top quarters above waist rail set inwards; Cole coupe on 30 h.p. Daimler; W, Jones all-weather body on 14 h. p. Angus-Sanderson; X, enclosed car interior by Alford and Alder illustrating sliding seats

the whole giving an idea of exceedingly great comfort.

Cane work was very much in evidence this year. Among the really fine bodies at Olympia was a Delaunay Belleville, finished in cane which was probably the most costly, as it was the most elaborately finished car there. It is not shown, but Fig. 5 shows two examples of this at O and Q, both examples of French work also. The Delaunay referred to was of the double door D-front with deep caned quarter panels, the sham caning being in black on a chocolate body color. At the back was a large oval-shaped light. The roof and upper quarters of the interior were panelled in a dark Spanish mahogany inlaid with scrolls of fancy woods, the roof further decorated and embellished with colored figures of the period and style of decoration of Louis XV. At the back of the driver's seat was fitted a cabinet with polished wood drawers and draw-out flaps. At the top of cabinet were inlaid toilet cases, cantines and mirror with watch holder. The whole of the interior represented a veritable lady's traveling boudoir, in which the interior color scheme was carried out to the last perfect detail, even to the sliding silk draw curtains. Carpet and similar accesories were made to match the color tint of the upholstery. The five-light center piece in the roof was artistically arranged. The front door at the driver's side were panelled in dark wood inlaid with rays of light mahogany radiating from the center circle which represented the sun and its rays

In the way of individual cars the Cunard people had some very nice bodies at Olympia. Thus at the Napier stand this firm showed three bodies, a landaulet, a coupe cabriolet and a sporting phaeton. The latter attracted a great deal of attention, for the reson that it was fitted with two distinct hoods, which could be used independently enclosing either seat at will. The rear one was fitted with a folding flap that gave protection to the legs of the occupants; when raised had side wings to which the flaps of the hood could be attached thus converting the rear portion into an enclosed body.

The same firm had a nice job in a saloon body on a Sunbeam chassis. This was constructed of heavy gauge aluminum panels with welded joints, these being burned over around the framing of the windows to render the exterior of the body jointless. Polished wood and inlays were used for the waist rails and interior parts.

The illustrations shown herewith have been selected to show the best of original designs and new lines from French, Belgian, English and Scottish coachbuilders of high grade along the lines laid down namely limousines, landaulets, coupes, broughams and saloons. A subsequent installment will take up the open cars.

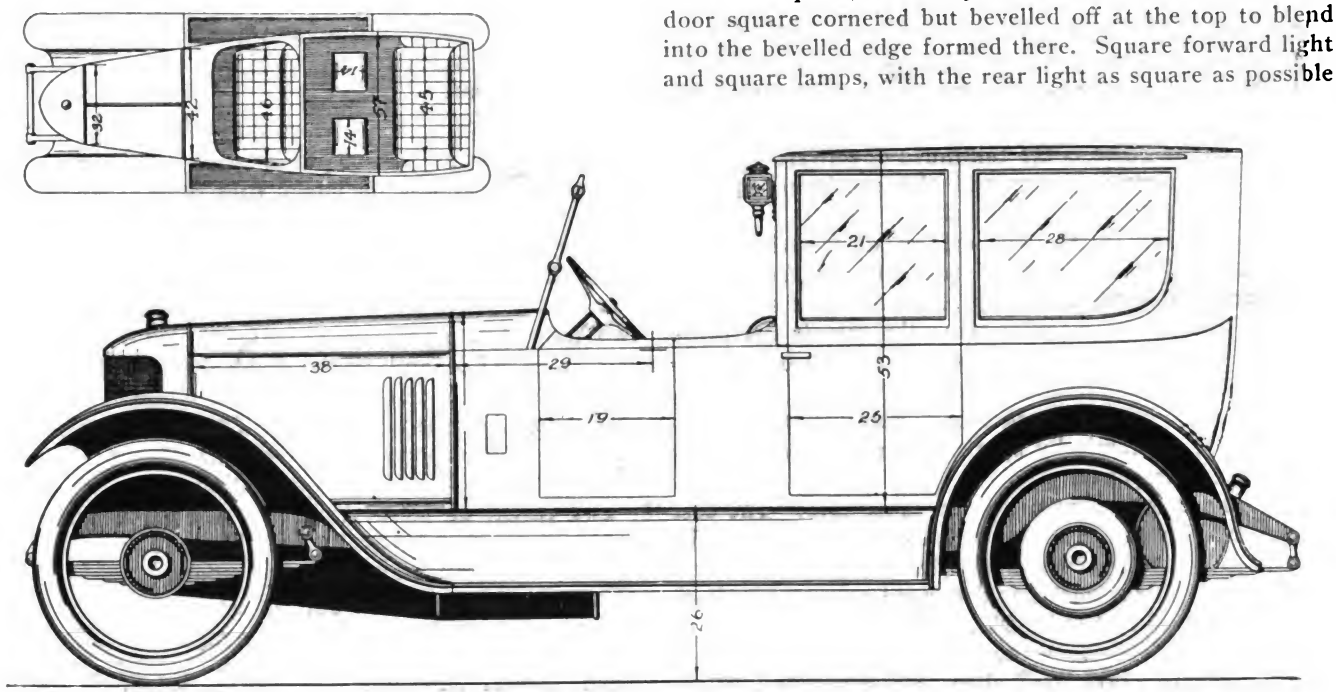
Ideal Car Serial—No. 11

Four-Passenger Brougham-Limousine

Specially designed for The Automotive Manufacturer by BEDA BROZIK

The usual limousine is too large and clumsy looking a body for the larger part of the town driving for which fine cars are used. Several years ago, a design called the town car began to supplant the large and heavier and larger vehicle in this use. The present design is an improvement on the smaller town car, designed for a long chassis, but larger carrying capacity and standing roof.

As the illustration shows, this has been designed along strictly modern lines, with the horizontal straight line and square corner prominent. The doors, of which there are four cut square, the body door exactly so, the driver's door square cornered but bevelled off at the top to blend into the bevelled edge formed there. Square forward light and square lamps, with the rear light as square as possible and still harmonizing with the rear end body curves, help to carry out the straight-line, square-corner idea.



Four passenger brougham-limousine, in the Ideal Car Series, designed along straight plain lines

A v-pointed radiator helps to convey the idea of speed, and to carry out the sharp line motif. The plainness and simplicity of the entire job is carried out even to the hood, in which the louvres are restricted to five on each side.

This job is laid out on a chassis with 137-in. wheelbase, standard tread, a rear kick-up in the frame. Other dimensions are: Bonnet width at front end, 32 in., at rear 42 in.; front seat width 46 in., rear 45 in.; width auxiliary seats 14 in.; rear compartment 57 in.; rear door width, 25 in.; height body only 53 in., overall 79 in.

Electric Convention Talks About Truck and Transportation

DEVELOPMENTS in the electrical industry in recent years seem to have been largely along the line of new electric vehicles, methods of manufacturing, charging and otherwise caring for, repairing and selling electric vehicles of all kinds, including industrial trucks, tractors, electric locomotives and other electrical transportation units. At least one would judge this to be the case from reading the reports of the Forty-third Convention of the National Electric Light Association, which was held at Pasadena, Cal., May 18 to 22,. Some of these papers which contain much of interest to automotive men, are summarized herewith, space preventing more detailed presentation.

Electric Claimed to Be Cheaper

Increased use of the electric truck within its field of usefulness is predicted in a paper by H. J. Butler and W. J. Burns, both of the Oneida Truck Co., Green Bay, Wis., read at the Electric Vehicle Section session of the N. E. L. A. Convention at Pasadena, Friday afternoon, May 21.

This prediction is predicated upon several stated facts, not the least of which is the continued downward trend of the cost of electric energy and the continued upward trend of gasoline, oil, hay and grain.

The paper points out that drivers of electric trucks are more readily trained than those for gasoline trucks, that when the electric truck stops, all mechanism stops and therefore cost of operation ceases; that repair items are reduced to the minimum because of the lack of delicate parts, and the cost of wear and tear is very low. Seventy-five per cent of all city truck delivery service can be performed more economically by electric trucks than by any other, states the paper.

Regarding comparative costs, the paper says: "The cost per ton mile for the gasoline truck has increased from 5.3 cents in 1915 to 6.75 cents in 1919, while the cost per ton mile for the electric truck has decreased consistently from 4.74 cents in 1915 to 4.17 in 1919.

"It likewise is interesting to note that the price of gasoline in August, 1915, was about 8½ cents per gallon, while toward the end of 1919 the price of 22 cents per gallon became standard. This is an increase of approximately 150 per cent in 4 years' time.

"Instead of such noticeable increase, the cost of electric current has decreased over the same period from 1.88 cents per kw-hr. in 1915 to 1.65 per kw-hr. in 1919."

Electric Superior for City Work

"Electric trucks operate much more economically and satisfactorily than any other type of motor truck when used within the mileage capacity of the batteries," stated C. A. Street of the Walker Vehicle Company of Chicago in his paper before the Electric Vehicle Section session of the N. E. L. A Convention at Pasadena, Friday afternoon, May 21.

For city use the electric truck is far superior to any other but the gasoline truck is preeminently fitted for longer, suburban and interurban hauls, and the application of this proved fact will save thousands of dollars to American industry," said Mr. Street.

"The complete, accurate operating cost records of large users of both gasoline and electric trucks prove that a 5-ton gasoline truck operating an average of 40 miles a day costs $5 to $10 a day more than an electric truck doing the same work," continued the paper. "This means a waste of $1,500 a year for each such truck.

Electric a Cooperator Not a Competitor

"The cost of operating the electric vehicle, taking all the factors into consideration, is about one-half that of the cost of gasoline transportation for similar operating conditions," says the report of the Transportation Engineering committee of the Electrical Vehicle Section of the N. E. L. A. presented at the Friday afternoon meeting of that section at the Association convention at Pasadena.

"The electric vehicle should be shown, not as a competitor of other kinds of transportation or agencies of transportation, but as a cooperative unit in the general transportation scheme. Educationally this is the only method of approach toward a proper understanding of the function of the electric vehicle, and a consequent intelligent use of it as a necessary and useful element of the transportation scheme."

Charging on a Large Scale Profitable

Proper combinations of power rates for electric vehicle charging and other commercial uses frequently results in lower rates, and salesmen for electric vehicles and for central stations should study each other's branch sufficiently to be able to cooperate and give the customer or prospective customer better service. In fact, the interests of the two industries are inseparable, states the report of the Electric Vehicle and power Sales Bureau Cooperation Committee, E. S. Mansfield of The Edison Electric Illuminating Company of Boston, Chairman, presented at the Friday afternoon session of the Electrical Vehicle Section of the N. E. L. A. Convention.

The extent of power load interests to central station companies in the electrical vehicle business is evidenced by the following quotation from the report.

"Three firms in one of our largest cities own a total of 444 electrics which consume an average of 17,000 kilowatt hours per day for at least 300 days in the year, and assuming a rate of two cents per kilowatt-hour represent an income to the central station of more than $100,000 per year."

If local conditions militate against the successful use of electrics, the power company employees should be cognizant of that fact, and both the vehicle salesmen and the company salemen should refrain from urging electric installation, since to do so would result only in dissatisfied customers.

National Handling Devices

Installation and operation of electric machinery for handling all materials in manufactories, depots, terminals and other commercial places offer the greatest potential field for development in the industry today, stated Zenas W. Carter, Manager of The Material Handling Machinery Manufacturers' Association of New York City in his address before the fourth general session of the N. E. L. A. Convention at Pasadena, May 22.

Only five per cent of the potential demand for handling machinery has been met, and since 85 to 90 per cent of all material handling machinery is electrically operated, the opportunity easily may be realized, he said.

A recent survey by The Literary Digest showed that in the industrial field alone there is a potential demand for

214,464 units, such as industrial trucks, tractors, locomotives, portable conveyors, electric hoists, etc. As each of these will require at least one motor it is estimated that they would consume an average of 1 k.w.h. each, or 8 k.w.h. each per day, a potential sale of 514,713,600 k.w.h. of electric energy per year of 300 days.

Only 15 per cent of steamship company docks, and 25 per cent of railroad terminals, are properly equipped with material handling devices. The paper estimates that the port of New York alone, if properly equipped with electric cranes, would require 3,000 cranes and hoists, with a potential electric-energy consumption of twenty million k.w.h. per year. A total of almost 500,000 motors would be needed for a country-wide system of freight transfer such as is in use in Cincinnati.

"Harwood Frost of Chicago, an engineer who recently addressed the Society of Terminal Engineers, stated the railroads might save over $400,000,000 per year in handling charges if electrically operated handling machinery were placed in the hands of transfer and freight men to help increase their daily output," said Mr. Carter.

Electric material-handling machinery will double the man-power value, said Mr. Carter. An example of the operation is given by citing the development in the new Studebaker Automobile plant No. 2 at South Bend, Ind., where, in addition to the use of cranes in the yard, continuous conveyors are utilized in the shops. Machines are located according to the operations to be performed on the various automobile parts, and in order to save all handling and movements of parts as they are finished by one machine, continuous conveyors make the trip down the shop and back, forming one circular track which is moving all the time. All the machinist has to do is to lift the part when it is finished and drop it on the conveyor running at the back of the machine. This automatically carries it to the machine next in rotation of operation.

Similarly, with the assembling, but wider conveyors are used. The axles are placed on at the correct wheelbase spacing, then move forward to the point where the frames are added. By the time these are attached the unit has moved forward to a well hole, where a two-motor crane lowers it to another conveyor on the first floor. This stock rack at this time contains all the parts needed for the car except engine, body and top, and provides space for workmen to work at the continuous assembling. The conveyor passes over pits in which men tighten the bolts and install parts on the underside of the chassis. Next it passes under a well from which the engine is lowered into place by other electric cranes, and subsequently, the body and top are added in a similar manner, so that the completed car can be run off the far end of the electrically-driven conveyor on its own wheels.

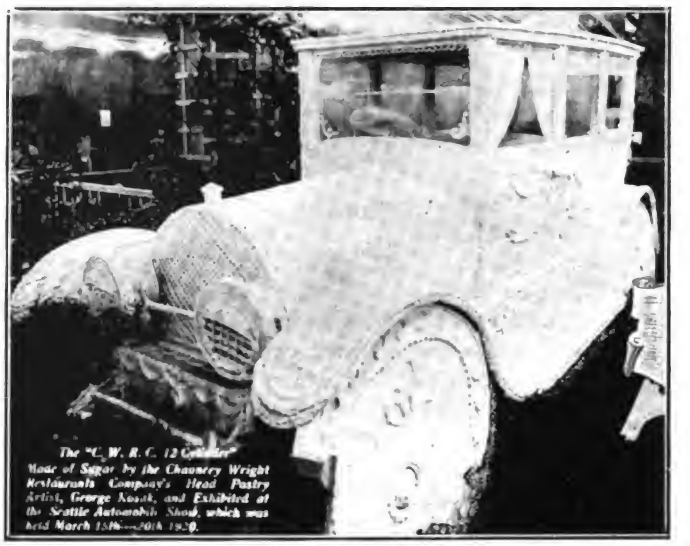
It was pointed out that this new Studebaker plant required 10,000 k.w. electric capacity, of which 2,400 k.w. are required for handling machinery alone. The assembly conveyors use two 5-h.p. motors for top assembly; one 15-h.p. motor for car assembly, and two 5-h.p. motors for axle assembly. The traveling cranes require 90 motors of various sizes; the cab hoists each require two large motors, and the other cranes two motors each. There are from six to ten electric trucks and tractors, and two thousand trailer trucks have been purchased.

Canada plans the standardization of its highways, and has appropriated $20,000,000 for road improvement in 1920.

C. W. R. C. 12-Cylinder Car Made of Sugar

A very interesting novelty was uncovered at the annual show of Seattle, held late in March, when the Chauncey Wright Restaurants Co., exhibited the sedan car shown in the illustration herewith.

The unusual thing about this new car, which was called the C. W. R. C. 12-cylinder, is that it was made entirely



of sugar. The artist who constructed this unusual car was George Kosak, head pastry artist of the company.

An examination of the details of the car will reveal the fact that Mr. Kosak knows motor cars equally as well as he does pastry.

Piling Oak Stock to Reduce Season Check

Body manufacturers who are accustomed to pile and air season dimension stock are aware that surface checking is a source of a lot of trouble and expense. One manufacturer states that 50 per cent of his cabinet repair costs are due to season checks.

Season checks, particularly in plain-sawed oak, are too often regarded by the practical lumberman as a necessary evil. The Forest Products Laboratory contends that these wasteful and costly checks can be prevented during yard seasoning simply by careful piling.

The primary cause of the trouble is that the plain-sawed surfaces of the stock are left exposed to the drying action of the sun and winds. The surfaces tend to shrink as they dry, but the interior of the stock, which is not drying so rapidly, resists the shrinkage on the surface. The result is a surface check.

To prevent surface checks, it is necessary to reduce and control the rate of drying from the plain-sawed surfaces. This can easily be done by proper piling. Each piece should be turned so that the quarter-sawed surfaces are on the top and bottom next to the stickers, and the plain-sawed surfaces, or the sides of the pieces, brought close together in the pile.

The effect of this method of piling is to retard the circulation and drying rate on the quarter-sawed surfaces. It is quite permissible for the quarter-sawed surface to be subjected to the more severe drying condition, because surface checking does not occur to any extent in these surfaces.

What Trade-Marks Are and How Obtained

Great and Growing Importance of the Trade-Mark to the Manufacturer Reaching Out for World Wide Business

ONE of the things the recent exposure of the attempted trade-mark piracy of the Portugese De Carmo did was to impress upon American automotive executives the necessity for protecting their marks in all those countries in which there is any possibility of ever doing any business. Furthermore, it served to point out that while the trade-mark is usually considered a minor matter and in value or importance is not classed with the patents taken out, the fact is that when it comes to foreign business the trade-mark and its registration may easily become of much greater importance than the patents. This is evident when one considers it this way. Of what value are patents to manufacture if, when completed, the machines can not be sold? And they can not be sold in foreign countries if the trade-mark has been registered by someone besides the manufacturer, particularly if that someone desires to be nasty. It was pointed out in a previous article (March, 1920, pages 20, 21 and 30) that the registration by some antagonistic person of a firm's trade-mark in one country of the Berne convention group would bar the product from all of those countries, unless the manufacturer were willing to pay tribute to that individual. And those countries are very large and important buyers of American products, including Argentina, Bolivia, Chile, Costa Rica, Cuba, Guatemala, Nicaragua, Paraguay and Venezuela in Central and South America, Austria, Germany, Hungary, Norway, Portugal, Serbia, Sweden and Turkey in Europe, and Japan and Turkey in Asia.

In these countries the protection is issued to the first registrant without proof of previous use or ownership. A new measure, fathered by the Merchants' Association of New York, makes the provision of mutual registration of trade-marks in those countries subscribing to it. It provides that any mark legally registered in one of the States shall be considered as registered also in the other States, and that the deposit of a trade-mark in one of the States gives the depositor a right of priority for a period of six months. The protection is made permanent by registration in the two International Bureaus. One of these Bureaus has already been established at Havana for the Northern Group of countries, and the other is to be established at Rio Janeiro.

The Director of the Bureau at Havana has announced that the privileges of international registration through his Bureau have been extended to the countries of the Southern Group which have ratified the convention, pending the establishment of the second Bureau at Rio de Janeiro.

This is called the International Trade Mark Convention, was proposed by the Fourth International Congress of American States at Buenos Aires, in 1910, and has been ratified by the Northern Group of Latin-American countries, also by five of the ten members of the Southern Group, and adhered to by one more. These are Brazil, Uruguay, Paraguay, Peru and Ecudor. Bolivia, while not signing the convention, has announced its adherance to it.

All of which leads one to ask, what is a trade-mark, legally, what does it amount to or what is it worth, and how obtained? According to William E. Richards of Richards & Geier, New York, a trade-mark is defined as a distinctive name, mark, emblem design, symbol or device, used on articles of manufacture or salable goods, either natural or artificial, to indicate or authenticate the origin or ownership of the goods to which it is applied or affixed, or in other words, to distinguish the goods of one person from those of another. Its value is in its employment, marking the goods on which it is placed. This gives it the character of property. It is then, a symbol of reputation or good will

Rightful Users of Marks

The trade-mark does not necessarily, and as a matter of law, import that the articles upon which it is used are manufactured by its user. It may be that they are manufactured for him; that he controls their production; or even that they pass through his hands in the course of trade, and that he gives to them the benefit of his reputation, or of his name and business style. Therefore, manufacturers, merchants, factors, and other may be the lawful users of marks.

Mode of Affixing Mark

All trade-marks must be attached in some way to the goods. The mode in which the mark is applied or affixed to the goods is immaterial. It may be printed, embossed, moulded, cast or otherwise applied on the goods, or it may be affixed to the goods, or to packages containing the goods by means of a label, plate or otherwise. It may be watermarked in translucent fabrics or materials, and in Hay & Todd Mfg. Co. vs. Querns Brothers, 86, Off. Gaz. 1323, it was held to be a sufficient method of affixing the mark to use it in advertising and to place a lithographed fac-simile of it on a card, in a box containing a quantity of the goods. On the contrary, it has been held that to display the mark on a show card placed on lots of candy in a show window, is not sufficient to establish a trade-mark right therein. Mere use of a mark in advertising or on stationery does not create any exclusive trade-mark right.

A Trade-Mark is Property

The right to a trade-mark exists in common law, and is protected even in the absence of statute. Good will is property and the courts proceed upon the ground that the trade-mark user has a valuable interest in the good will of his trade or business, and that having appropriated to himself a particular and distinctive label or sign or trade-mark, indicating that the article is manufactured or sold by him or by his authority, or that he carries on his business at a particular place, he is entitled to protection against any other person who pirates upon the good will of his customers or of the patrons of his trade or business, by using his mark without his authority or consent.

The relief afforded by the court is, however, often expressly placed upon the ground of an exclusive property right in the use of the trade-mark itself.

Adoption and Use of Mark Necessary

The adoption and actual use of the mark in commerce is a pre-requisite to the ownership thereof in this country.

Mere adoption with intent to use in the future will not create a trade-mark right.

It is not necessary that the mark should have been used for any definite or considerable length of time, and a single actual use confers a right to such word or mark as a trade-mark, if the article with the mark upon it has actually become a vendible article in the market, with the intent upon the part of the proprietor to continue its production and sale.

As above stated, the mere use of a mark in advertising or on stationery does not create any exclusive trade-mark right.

Priority of Adoption and Use

The basis of the right to a trade-mark is priority of adoption and actual use in trade.

The first one to so use a given trade-mark upon a particular class of goods acquires the prior and exclusive right to use it upon that class of goods; another person may subsequently apply the same mark to a different class of goods, and if he is the first to do so, he also acquires an exclusive right to the use of the mark for the goods embraced in the different class.

A casual, intermittent, inconsiderable and experimental use is insufficient to confer priority right, although prior in point of time.

Valid Trade-Marks

While any mark such as above described, which has been adopted and used for the purpose of identifying certain goods as being of a certain origin or ownership may constitute a valid trade-mark, it is necessary that it shall be such as will not prejudice the rights of others if exclusively appropriated, and certain rules have been established in practice, by the decisions of the courts in trade-mark cases, which aid in determining what may and what may not constitute a valid trade-mark. The following are of interest:

The mark must be free from misrepresentations and bad faith.

A trade-mark must consist of some definite word or words, sign, or device, or combination of the same. It must be distinctive, and either by itself, or by association and use, indicate a distinctive origin or ownership of the goods to which it is attached, so that it will perform its function of distinguishing the owner's goods from those of other persons.

Invalid Trade-Marks

An exclusive trade-mark cannot be.

1. A sign, mark, or form of words which, from the fact conveyed by its primary meaning, others may employ with equal truth and equal right for the same purpose.

2. Words, names, and marks already known and in general and common use in the trade cannot be exclusively appropriated as a trade-mark.

3. A mark or name so similar to an existing trade-mark of another person as to create deception or confusion as to identity of goods cannot be a valid mark.

4. Descriptive words, marks, terms, devices, or names which refer to the quality, style, character, grade, or class of the goods, or that are merely descriptive of the goods or business to which they are applied are not valid marks. A peculiar or distinctive style of printing, or merely misspelling or using a foreign language equivalent of a common descriptive word, will not sustain an otherwise objectionable mark as a valid trade-mark.

Words merely descriptive of the ingredients of an article, or of its mode of composition, and words or marks merely indicating superior quality, excellence, popularity, or extent of use, do not constitute a valid trade-mark and the same is true of words indicating the purpose or use of the article, or the effect produced by its use.

5. Geographical or place names; although if used in an arbitrary or fanciful way to indicate origin and ownership regardless of location, they may be sustained as valid trade-marks.

6. Persons or corporate names alone are not valid marks, but when combined with other unobjectionable words or devices they may constitute a good trade-mark.

7. Color alone cannot be a valid trade-mark, but if used in a particular design, such as a triangle, square, or circle or used in connection with other devices or characters, it may form part of a good trade-mark.

8. Neither the mere form, size, or shape of the goods, packages or labels, the package itself, or the substance, or the whole or any useful part of the article, can be appropriated as a trade-mark.

9. Pictures of the article itself, or of the goods contained in the package, or which are descriptive of the goods, are not good marks.

Examples of Invalid Marks

As examples of marks that have been declared invalid because either descriptive, geographical or containing a misrpresentation, may be mentioned.

Acid Phosphate, for medicines.
Aluminum, for washboards.
Asbestos, for shoes and wall paper.
Barber's Model, for razors.
Borax, for soap.
California Syrup of Figs, for medicines.
Castoria, for medicines.
Cherry Pectoral, for medicines.
Copenhagen, for snuff.
Crack Proof, for rubber.
Dessicated, for condfish.
Durham, for tobacco.
Elastic Seam, for drawers.
Elgin, for watches.
Famous, for stoves.
Favorite, for letter file.
Getwell, for medicines
Gibraltar, for lamp chimneys.
Gold Label, for bread.
Granite, for enameled ware.
Health Food, for foods.
International Banking Co., for name of concern.
Inter-phone, for telephone apparatus.
Keepclean, for toilet brushes.
Kid Nee Kure, for medicine.
Linoleum, for floor cloth.
Malted Milk, for infant's food.
Naptha, for soap.
No Sag, for hand bags.
Pork Roll, for pork products
Rubberset, for brushes
Ruberoid, for roofing.
Standard, for photographs.
Straight Cut, for cigarettes.
United States, for dental rooms.
Valvolene, for oils.
Worcestershire, for sauce.
Yale, for locks.

1. Existing words used in an arbitrary or fanciful way.

2. Abandoned trade-marks may be appropriated by others and become their exclusive property even as against the original users.

3. Marks used upon a certain class of goods by one owner may be appropriated for a different class of goods by another.

4. An invented or newly coined word or phrase, or some arbitrary or fanciful term, figure or device, not descriptive of the article to which it is applied.

5. Numerals, letters and initials are valid trade-marks

when used in an arbitrary manner, but not when used to indicate grade or quality.

6. Fictitious, mythological or historical names of persons or things.

7. Devices, symbols or pictures, either alone or in combination with words or names, which are not by their inherent character descriptive of the character or quality of the goods, and contain no misrepresentation of fact with relation to the goods or their origin.

8. A portrait of the proprietor of the goods, or of celebrities, either alone or in combination with words or other devices, but portraits of living persons should not be used without their consent.

9. The autographic signature of the proprietor either alone or in combination with words or other devices.

10. Foreign words, phrases or letters if not descriptive of the article.

11. A collation of words one or more of which must be arbitrary and distinctive.

Examples of Valid Marks

As examples illustrative of marks which have either been protected against unfair competition, or the right to their use as trade-marks been upheld by the courts, may be given:

Alderney, for oleomargarine.
Anatolia, for licorice.
Anchor Brand, for wire.
Auburn Lynn, for shoes.
A. H. V., for gin.
B. B. B., for medicine.
Beaded, for lace tips.
Bovril, for meat extract.
Bromidia, for medicine.
Centennial, for clathing.
Charter Oak, for stoves.
Cottolene, for lard substitute.
Crown, for baking powder.
Cream, for baking powder.
Cuticura, for toilet soap.
Don Carlos, for olives.
Electro-Silicon, for polishing material.
Elk, for cigars.
Emolléa, for toilet cream.
Eureka, for fertilizers; shirts; fire hose, etc.
Excelsior, for stoves; soap, etc.
G. J. G., for automobiles.
H. M., for plumber's supplies.
Home, for sewing machines.
Hoosier, for drills.
Hygeia, for water.
Insectine, for insect powder.
Iron Clad, for boats.
Lacto-Peptine, for medicine.
Lightning, for hay knives.
Magic, for scythe-stones.
Magnetic Balm, for ointment.
Nickel, for soap.
No-To-Bac, for medicine.
O. F. C., for whiskey.
Omega Oil, for liniment.
Radium, for silk.
Roof Leak, for roof paint.
Royal, for baking powder.
Sapolio, for cleaning compound.
Shawknit, for stockings.
Star, for shirts, iron, oil, soap, etc.
Sunlight, for soap.
Sunshine, for stoves.
Trilby, for gloves.
Valvoline, for lubricating oil.
Velvet Grip, for hose supporter.
Vulcan, for matches.
Wearever, for aluminum ware.
Yucatan, for leather and leather goods.

Descriptive and Suggestive Marks Distinguished

It is very difficult to draw a clear line of demarcation between names, words and symbols that are inherently descriptive in character and which are therefore not proper subject-matter for exclusive appropriation as trade-marks, and those that are merely suggestive, and are not objectionable as being descriptive. Indeed the courts in the decisions handed down in such cases often seem contradictory and confusing.

Suggestive names and words are often very valuable, and if merely suggestive or figurative they may form valid marks notwithstanding that they may also be indirectly or remotely descriptive.

Perhaps as good a rule as any to distinguish between descriptive and suggestive marks is the following: if it requires the exercise of the imagination to make the mark descriptive of the goods or business or some character or quality of the same, then the mark is suggestive only, and in the contrary case the mark will be descriptive.

As examples of suggestive marks may be instanced the representation of a domino sugar; "Crystal" for castor oil; "Damascus blade" for scythes; "Water White" for kerosene; "Annihilator" for medicine; "Baffle" for safes; "Elastic" for bookcases; "Epicure" for canned salmon; "Filofloss" for silk; "Holeproof" for hosiery; "Norub" for laundry aid; "Pain-Killer" for medicine; "Wearever" for aluminum ware.

Trade-Names

Perhaps as good a definition of the term "trade-name" as any is the one given by Hopkins in his excellent work, "Hoppins on Trade-Marks," page 13, as follows: "A trade-name is a word or phrase by which a business enterprise or business location or specific articles of merchandise from a specific source are known to the public, and which when applied to merchandise is generic or descriptive, and hence not susceptible of appropriation as a technical trade-mark."

Trade-names are names which are used in trade to designate a particular business of certain persons, or the location of a business, or specific goods, but which are either not applied or affixed to the goods when sold, or which, when so applied or affixed, are for one reason or another not capable of exclusive appropriation as technical trade-marks.

Trade-names are acquired by adoption and use, and belong to the first one to adopt and use them and give them value.

Trade-names are protected by the courts against misuse or imitation upon the ground of unfair competition.

Unfair Competition

Unfair competition is the passing off, or attempt to pass off, the goods or business of one person for the goods or business of another person, and any conduct, the natural and probable effect of which is to deceive the public and to pass off the goods or business of one person for that of another amounts to actionable unfair competition.

In cases of unfair competition the courts of equity intervene to protect from fraud both the complainant whose business is or may be injured by unfair and fraudulent competition, and the public who are consumers of his merchandise.

Unfair competition embraces all forms of misrepresentations of identity. In the language of the Supreme Court of Wisconsin "unfair competition in trade is not confined to the imitation of a trade-mark, but takes as many forms as the ingenuity of man can devise. It may consider the imitation of a sign, a trade-name, a label, a wrapper, a package, or almost any other imitation by a business rival of some distinguishing earmark of an established business, which the court can see is calculated to mislead the public and lead purchasers into the belief that they are buying goods of the first manufacturer."

The basic principle is that no one has a right to dress up his goods or otherwise represent them in such a manner as to deceive an intending purchaser and induce him to believe he is buying the goods of another. Relief from unfair competition is properly afforded by the courts upon the ground that one who has built up a good will and reputation for his goods or business is entitled to all the benefits therefrom, as such good will is property, and like other property is protected from invasion.

The courts of equity will not allow a man to palm off his goods as those of another, whether his misrepresentations are made by word of mouth, or more subtly by simulating the colorations of details of appearance by which the consuming public has come to recognize the product of his competitor, and therefore will intervene to prevent a rival trader from imitating names, marks, labels, forms of package, or dress of goods, so as to deceive purchasers and pass off his goods as those of another, and this irrespective of any question of exclusive proprietary right in the names, marks, labels, etc.

Whether or not the goods or business of the subsequent trader have been sufficiently distinguished from those of a competitor to avoid unfair competition is a question of fact to be determined in each case. Similarity of general appearance sufficient to cause confusion or to deceive the public is the test, and public cannot be expected to exercise close inspection and discrimination. If the distinctive part of a name or mark is taken or imitated, minor differences afford no defense, and alleged distinguishing features which are not likely to be observed or to attract attention are insufficient.

The copying or imitation of the circulars, advertisements or announcements of a competitor, calculated to deceive the public and to pass off the goods or business of one person for those of another is strong evidence of fraud and unfair competition and is ground for an injunction.

A manufacturer or dealer may not substitute the goods of one person for those of another when the latter's merchandise is ordered, without giving notice to the purchaser of the fact. This is unfair competition and actionable, as it is fraud not only upon the public but also upon the manufacturer whose merchandise was ordered, and whose business is injured by the substitution.

In N. K. Fairbanks vs. Dunn, 126 Fed. Rep. 227, the Court in granting an injunction in such a case said.

"The law is too well settled upon this point to require extended quotation. The manufacturer of an article placed upon the market for sale has the right to demand of the dealer who purports and advertises to sell it that he deliver his product when called for by the customer."

The Doctrine of Secondary Meaning

Words or names that in their primary meaning are generic or descriptive, and are therefore, not capable of exclusive appropriation as a valid trade-mark, such for example, as words or symbols naturally descriptive of the goods, or the place where they are made, or the name of the maker, may acquire a secondary meaning by long and continued use in connection with the goods or business of a particular trader, provided that such use has been sufficient to have caused such words or names to be understood by the public as designating the goods of that particular trader.

Such words or names therefore have both a primary and secondary meaning. In their primary meaning they are public property and anyone may use them. In their secondary meaning their employment and use may be protected upon the ground of unfair competition.

In Standard Varnish Works vs. Fisher, 153 Fed. Rep. 928, 930, the Court said as follows.

"Words or symbols naturally descriptive of the product, while not adapted for exclusive use as a trade-mark, may yet acquire, by long and continued usage in connection with the preparation and by association with the name of the manufacturer, a secondary meaning or signification, such as will express or betoken the goods of that manufacturer only, and in this sense he will be entitled to protection from an unfair use of the designation or trade-name by others that may result in his injury and in fraud of the public."

There is an exclusive right to such a secondary meaning of a word or name that has ben deemed a property right which will be protected by the courts, but this exclusive right is strictly limited to the secondary meaning of the word or name.

(To be continued)

Aircraft Technical Note on Dopes and Fabrics

By Lt. H. A. Gardner, U. S. N. R. F.

Fire Resisting Dopes. Dopes made from cellulose acetate have for some time been given the preference, even though they are more expensive than dopes made from cellulose nitrate. This is due to the fact that the cellulose acetate dopes are relatively non-inflamable. It should be remembered, however, that the production of cellulose acetate requires large quantities of glacial acid and acetic anhydride. These chemicals are hard to obtain or difficult to produce and are required for the manufacture of many other important war materials, including medicinals. For this reason the readily available and low priced cellulose nitrate dope should be used wherever possible. On account of the fact that such dopes are inflamable in nature, attempts have recently been made to render them relatively non-inflamable by pigmentation. For instance, the incorporation of 5% of ammonium phosphate or ammonium magnesium phosphate adds very greatly to the fire resisting nature of cellulose nitrate dopes. In fact, such dopes when applied have been found in many tests to be quite as fire resistant as the best grades of cellulose acetate dopes. Exposure tests on such dopes, as well as actual tests on several machines, are under way.

Non-Inflamable Fabrics: Some investigations have been made on non-inflamable fabrics submitted to the Bureau for test purposes. These were found to have been treated in a well known manner, which consists of impregnating a fabric with ammonium phosphate or similar salts in aqueous solution and then drying. Fabrics thus treated are to some extent fire resisting. When ignited by flame, the heat developed is sufficient to extinguish the blaze. Cotton and linen airplane fabrics may be rendered less subject to fire danger if treated with ammonium salts previous to doping. Experiments on such materials are now being made.

Despite the shortage of oil and the fact that the only bid received was for 1,350,000 to 2,000,000 bbls. against announced needs of 19,000,000 to 28,000,000 bbls., the Shipping Board rejected the bid because of the high price. It varied from $1.30 to $1.60 a bbl.

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Vol. LXII JUNE, 1920 No. 3

A Desirable, Possible Source of Economy

ONE thing that might be brought to the attention of all prospective candidates for Federal office is the possibility of effecting enormous economies by reducing the Federal working forces at Washington and elsewhere down to somewhere near pre-war normal figures. The statement has been made in one of the monthly journals that before the war Uncle Sam got along with 35,000 employees in Washington, and 265,000 outside, a total of 300,000, and that the total now is 101,000 in Washington and 650,000 outside, or 751,000 all told. This same article stated that only 8,000 Federal employees had been fired in Washington since Armistice Day.

If these statements were correct the situation would be pretty bad, but as a matter of fact the figures are not correct. The number of employees on June 30, 1913 (which corresponds to that indefinite phrase "before the war") was 469,879. On Nov. 11, 1918, there were 117,760 Federal employees in the District of Columbia, and it is estimated by the Civil Service Commission, 750,000 outside of the District, or more than 867,000 all told. According to the Bureau of the Census on July 1, 1919, there were 657,744 Federal employees outside the District, which is believed to have been reduced since then to about 550,000. On April 15, 1920, there were 98,836 Federal employees in the District. This and the estimate show that the Government forces have been reduced to about 650,000 total as of April 15.

Of course even this estimated drop from 867,000 to 650,000 is not a large one when the pre-war figures of 470,000 are considered. It is estimated that the average pay of all Federal civil service employees is not over $1,150 a year. Using this as a basis, the present Government employees are costing us $750,000,000 a year and the reduction of the pre-war figures would cut this to $540,000,000. Here is a saving of $210,000,000 a year to say nothing of releasing to industries which need them badly, no less than 180,000 workers. Business men would welcome these workers with open arms, to say nothing of welcoming in an equally hearty manner the Government economy which their release would mean. It is a matter which those concerned should give considerable thought. On July 1, the War Dept. must let 5,000 people go because of reductions in the appropriations for that department by Congress.

Fuel Scarcity May Add to Gasoline-Electros

ABROAD where gasoline is very difficult to get and approximates $1 a gallon, there is taking place a development, or perhaps it should be considered only as the beginning of a development, toward the gasoline-electric vehicle. This is the form of vehicle in which a gasoline engine of relatively small size is used to drive a generator which supplies current to electric motors within the rear wheels. At first sight a complicated arrangement, and one which has been tried in this country but not popularized, upon close analysis, it will be noted that the arrangement has many advantages, especially in the light of fuel at $1 a gallon and hard to get at that.

A smaller, and thus a more economical engine can be used. It runs at practically a constant speed, which lessens or eliminates many common troubles and makes for economy of operation in other ways. Transmission troubles are eliminated, and the control of the car is simplified, which may permit of economy in the selection of the driver. Through the elimination of clutch and gear changing, noise and the attendant wear are eliminated or much reduced, while the greater number of speeds possible without complicating the electric controller gives the vehicle greater flexibility. For hills and emergencies the use of full engine power, plus battery capacity, gives a total which is equivalent to the over-large engine generally used. The smaller battery needed costs less and is more easily and quickly charged than the very large and heavy battery on wholly electric vehicles. Otherwise, it has the advantages of both the electric and the gasoline car and a few of its own.

Perhaps 50-cent motor fuel this summer which the oil men are predicting with such certainty, will bring serious consideration of this combination, so that it will come back into use. As a straw showing a slight wind in this direction, it may be noted that one large Western manufacturer of gasoline trucks last winter at truck show time, brought out a parallel and additional line of electric trucks. These were presented solely on their merits as better under certain conditions of use than the gasoline forms, Isn't one such condition that of very scarce and high priced fuel. And if so, isn't the combination gasoline-electric vehicle a better transition medium?

It is said a British company has contracted for an all-British airway extending from Pernambuco, Brazil, to Buenos Aires, Argentina, a total distance of 2,600 miles with 12 air ports or stops. Air mail and passengers are to be carried from the start, and the promoters hint at cargoes also.

The truckmen, most of whom are now motor-truckmen, of many cities are combining to effect economies and increase hauling efficiency. This has been done in New York, Detroit, Chicago, Cleveland, Pittsburgh and other cities.

Highway Transportation's Relation to Increased Production

By GEORGE M. GRAHAM*

How Transportation Reduces Costs, Highways Not Carrying Their Share—War Emphasized Importance of Roads—Railroad Men Advocate Trucks

THERE is increasing among the nation's constructive leaders a patriotism based on practical considerations. This patriotism believes that the greatest good to the greatest number can best be achieved by an enhanced development and distribution of our natural resources. It is to those who hold with this view that I address myself. The advocates of highway traffic are proud to plead their cause from the same plaform as their elder brothers in transportation, the railways and the merchant marine. We have no thought to be their rivals. We aspire to supplement them in a transportation trinity as suggested by former Secretary of Commerce Redfield.

The relation of all three traffic factors in respect to production would seem to be definitely established.

Our merchant marine maintains our contact with the outside world and also moves freight over our inland waterways.

The steel rail has ever been the herald of development and progress, but experience has shown that the profitable operation of railroads is largely a matter of bulk shipment over extended distances.

The highways offer an infinite possibility of local communication.

Increasing production rests mainly on enlarged highway transportation, perhaps the least developed of our great national assets. The highway can aid the railways in the immense task of serving 105 million persons, spread over 3 million square miles. It directly touches the home life of more people than all other transportation mediums combined.

As we sense production, there are four main kinds, which I range in the order of their importance.

1st. Food.
2nd. Fuel.
3rd. Raw material.
4th. Manufactured articles.

All four kinds of production depend on consumption, and the connecting link between the two is transportation. Wherever we can more closely join the point of production with the point of consumption we assure increased output.

We have seen within the last month the deadly effect on production of interrupted railway facilities. A few thousand switchmen at various points suddenly discontinue work. The result is a wide-spread paralysis of production, as complete as though for the time being the essentials of manufacture, material, machinery and labor, had been completely destroyed.

The dictatorship of distribution was here proved absolute. When shipment stopped, the business of the nation was prostrated. Consumers and manufacturers suffered alike, business shrank, money was lost, and public convenience, health and even life were placed in jeopardy.

The producer experienced equal distress. His inventory piled up. He sought storage facilities in vain. Capital lacked to run his business. Even if he still had raw material, he hesitated to produce more, lest he merely increase congestion and aggravate his problems. So production lagged and prices mounted.

Virtually every economist will prescribe production as the remedy for most of our present ills. It is the answer to high prices. It is the nearest approach to a panacea for labor disputes. It is the medium of mercy to Europe.

Effect of Transportation on Prices

If anyone doubts how far transportation affects prices, let him recall that the great obstacle to a necessary increase of railway freight rates is the fear that such a raise will add to virtually all living costs.

Freight now moves over the United States via the following:

15,000 miles of canals and inland water ways,
259,000 miles of railways,
2,753,334 miles of highways.

In discharging its distribution function, the highway presents potentials not generally understood. The total of

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Address delivered at Eighth Annual Meeting, Chamber of Commerce of U. S., Atlantic City, April, 1920.

Motor truck train, which was used during switchmen's strike, to carry motors from manufacturer in Detroit to Cole Motor Co., user, in Indianapolis. Taken at Toledo, where motor shipment nad been held up

surfaced roads in the United States is greater than the railroad mileage, being 296,290, 12 per cent of the total, against 259,000 miles of railroad. It should be freely conceded. however, that much of what is here termed surfaced road is barely passable.

Exact tonnage figures are not available. The best estimates show that on the Great Lakes and Mississippi in 1918, 90,000,000 tons of freight were carried. In the same year 2,504,000,000 tons were moved by rail, and 1,200,000,000 by motor truck.

Highways have fallen short of carrying their share because only within the decade has a medium been developed to escape the limitations of the man-drawn, ox-drawn and horse-drawn vehicle, used for fifty centuries.

Many elements have combined to prevent the rapid application of the motor truck to highway transportation. It was not like Adam, born mature. It had first to be perfected that its efficiency might declare itselff.

We have been hampered by ill-considered and in many ways unjust legislation. Bad roads have retarded our development and in this connection I ask you to note that our trucks have been just as much sinned against by bad roads as they have sinned by damaging such roads.

But the greatest immediate obstacle to the expanding use of trucks has been our failure to fit in our activities with those of the railroads.

In spite of all these handicaps this development has already carried far. I should like to illustrate the progress with an example from official records.

Importance Recognized by Industries Board

During the world war the most drastic powers ever vouchsafed any governmental agency were vested in the War Industries Board. These powers included arbitrary control of fuel, transportation, raw material and labor. The manufacturer could operate only providing the War Industries Board had classed his output a war essential.

The motor truck industry in due course was summoned to Washington to prove its case. It was told that, with steel lacking for war purposes in France, the misuse of one pound was treason, and that only under conditions of utmost urgency could steel be granted for trucks to be used in this country.

The reply made by the motor truck industry best proves the place taken by the power vehicle in our transportation fabric. Its spokesman submitted to the War Industries Board a list of the industries the Board itself had voted to be essential to the war program. There were seventy-one kinds represented. All carried full priorities.

An anlysis showed that of the seventy-one kinds of manufacture, sixty-six were using motor trucks to speed up production. These included thousands of the biggest firms in the United States. The Board immediately granted the steel.

I believe that an almost equally forcible case could have been made for the passenger car, for that too must be considered in all questions involving highways transportation. The utility use of the motor car has won for it a place as a staple commodity. It is essentially a transportation medium.

Passenger Cars Furnish Individual Transportation

The only usual difference between the truck and the car is that the truck transports freight, and the passenger car transports persons. The difference between the passenger car and the railroad car is that the latter carries persons in number, whereas the automobile furnishes an individual transportation of infinite convenience and advantage.

We believe that the good will of railway officials to highway transportation is near at hand.

During the war Director Hines urged that wherever possible freight should be diverted to motor trucks to lessen rail congestion.

Railroad Men Advocate Trucks for Short Hauls

C. A. Morse, also of the Railroad Administration, has offered this opinion:

"Considered as a unit practically none of the small branch railway lines feeding trunk lines pay expenses. The traffic gathered by them is turned over to the main line with a deficit attached, which has to be overcome during the main line movement before any profit is made. It would be a decided advantage if this traffic could be delivered to the trunk line by means of motor truck."

R. C. Wright, General Manager of the Pennsylvania Railroad, has stated that there is small advantage in handling L. C. L. freight up to forty miles. His advocacy resulted in the appointment of a committee from the American Railway Association to analyze short haul conditions and to welcome overtures from reputable motor truck companies to handle such freight.

We do not like to dwell unduly on the war as having established the place of the truck, yet beginning with the President of the United States it would be possible to quote virtually every war official of prominence in witness to the practical aid given by motor trucks. Surely this service can be extended to peace needs.

Railroads have learned that prosperity cannot be defined alone in terms of tonnage.

Formerly, the railroad in its capacity as public carrier, was not in a position to refuse unprofitable freight. Now, this can be diverted to a new and suitable medium, which permits the railroad to concentrate on profitable freight.

Temporarily our railroads have reached the limit of their capacity. As now equipped they can handle no greater volume. Railway Age says they are 712,400 freight cars short. Only 50 per cent of locomotives needed are available. Five years is suggested as the minimum time in which railroad facilities can be brought to normal.

Meantime is it not sound logic that present railroad equipment should be limited to remunerative work, leaving the short haul, L. C. L., to other mediums?

No rational person considers the motor truck a rival of the railroads in long haul traffic.

Trucks Cannot Compete with Railroads Over Long Distances

It has performed wonders in occasional emergency service, but the labor factor eliminates it for long distance work.

A modern freight train will move 3,000 tons with a crew of six men. The same tonnage by motor truck would require 600 five-ton trucks, at least 600 drivers and possibly 600 helpers.

That there may be wisdom in a re-arrangement of our present methods is suggested by a brief analysis of the facilities of the short haul steam railways of the United States. This class I have limited to railroads having a maximum trackage of 100 miles, although many lines with more than this render a short haul service.

Short Haul Lines and Their Equipment

The figures were obtained from the Short Line Association, and are accurate as of April 1st. They show 659

roads of 100 miles or less. Their total mileage is 116,860 an average of 25.6 miles each; 160 are less than 10 miles in length, their average being 6.4 miles; 419 roads are less than 25 miles long, their average being 12.6 miles. The total number of locomotives, of the 659 roads, is 2,491, an average of 4 each; 133 roads have but one locomotive.

A foremost railroad authority has frankly conceded that no longer will such lines be constructed either as individual lines or branches of trunk lines.

If Mr. Wright is correct in his figure of 40 miles as the minimum distance for L. C. L. haulage, then there is no place for almost two-thirds of them. The future tendency will be to substitute other agencies.

In planning to eliminate such roads there arises the problem of taking care of their owners. Stockholders should be protected, but a system which is economically in error cannot be maintained artificially.

In many cases these lines were established by trunk railroads to serve as feeders. Their stockholders might be compensated through an exchange of their securities for stock in the parent company. It is possible also to sell at profitable prices all equipment, including rails, freight cars and locomotives. In some cases terminals might be taken over by trucking companies.

Typical Case of Trunk Line vs. Railroad

There is also the suggestion that stockholders in short line railways might themselves embark in motor truck haulage. In connection with the growing rivalry between short line rail companies and motor truck haulage concerns I have selected from a mass of litigation one case that is typical. It shows all the arguments, good and bad, all the handicaps and possibilities of both sides.

This case was heard before the Public Service Commission of Nevada. It concerns the effort of two Italians, Ginocchio Brothers, to get a certificate of public convenience to operate a motor truck haulage company. Opposed to them was the Virginia & Truckee Railway Company, operating between Reno and Minden.

The railway company had much on its side. It was in possession of right of way, and claimed to be operating satisfactorily. It paid its taxes. It was asked that Ginocchio Brothers be compelled to deposit bonds to the amount of $10,000, establish freight stations and passenger depots and adhere to complete tariff shedules. It argued that the truck company could not operate during part of the winter, whereas the railroad was an all-year service.

But especially instructive was the railroad's presentation of the financial phases of the subject. It was set forth that the net income was only $8,845 for the year ending June 30th, 1919, that the scrap value of the railroad was $450,000, that if the owners saw fit to junk their assets and invest in staple securities, they could get an income of $27,000, or three times as much as their operating gains.

It was also urged that the addition of another carrier would depreciate the revenue of the railway, result in poorer service and higher charges.

Ginocchio Brothers argued service. They proved that their trucks covered 51 miles between Reno and Gardnerville in three hours and twenty minutes, picking up and delivering freight at residences, farm houses, warehouses and stores. Two or three days elapsed in similar railroad freight shipment.

The truck service was said to be no more disqualified by storms than that of the railway.

Many customers supported the Messrs. Ginocchio, and said they gave a service not possible by the railroad.

The Commission ruled that railroad freight service for short distances in less than carload lots has become wasteful and obsolete. It granted the right of operation to Ginocchio Brothers, welcomed the addition of such service for the agricultural, live stock and mining sections of the state, and recommended that the railroads install similar facilities.

Properly speaking, there never should have been any conflict in this case. Under a proper system of co-operation, the effort would be to find out which of the mediums could most economically, efficiently and profitably serve this section. This determined, the right facilities could be applied, and the other withdrawn.

Truck Lines and Railroads Should Co-operate

With co-operation and constantly increasing efficiency, motor trucks should be able to serve the great central truck railway lines by hauling to them, free of deficit, a volume of tonnage to be moved distances in bulk.

State utilities commissions everywhere are studying highway motor transportation. Such researches divulge amazing instances of service. There is one forty mile route between Akron and Cleveland which relieves the railroad between these cities of a demand for 800 freight cars weekly, suggesting a possible yearly saving of 40,000 cars for other purposes.

The great strain in our modern transportation systems is to be found at the terminals. Freight cars move on an average of only 25 miles per day. We also have the spectacle of something like 2,400,000 freight cars with an average capacity of 50 tons carrying seldom as an average more than 32 tons carload lot shipments and 7 tons in L. C. L. shipments.

If we could, by abolishing junction and terminal delays, bring the daily average mileage up to 37½ miles per car, there would be the equivalent of an addition of 1,200,000 cars.

At such centers as New York, Cincinnati, Minneapolis, Cleveland, Louisville, Grand Rapids and St. Louis motor freight terminals are exercising important influences on transportation and production.

In New York trucks collect freight from various points within a radius of thirty miles, then haul it to an outlying terminal, Mott Haven, to escape central congestion. It is then shipped in railway freight cars to Boston and thence distributed by trucks within a radius of thirty or forty miles.

This properly allots haulage—the short distance for the truck and the long distance for the railwoy. It eliminates two or three minor railroads and consequent congestion and delay at the junction points.

What Trucks are doing for Cincinnati Terminals

The entire transportation industry of the United States is studying with interest the achievement of Cincinnati, recently informatively presented in the Saturday Evening Post by Mr. Hungerford.

In Cincinnati railway terminals are bunched, yet owing to truckage congestion, an average of two days and fourteen hours used to be required to move a freight car a few miles between stations. Now similar distances are covered in fourteen minutes by fifteen five-ton trucks, which transfer freight from terminal to terminal.

(To be continued)

Taylor Society Presents New Industrial Developments

IMPORTANT new developments in labor relations, management, production methods and selling were brought out at the meeting of the Taylor Society held in Rochester, N. Y., May 6, 7 and 8. Prominent manufacturers, managers, industrial engineers and sales executives from all parts of the country presented papers and took part in the discussions which proved that the society, which has for its object the promotion of scientific management, is extending its field beyond the factory. The meeting was held under the auspices of the Industrial Management Council and the Manufacturers' Council of Chamber of Commerce.

The first regular session was held on Friday morning, Henry S. Dennison, President of the Taylor Society, presiding. Mr. Dennison, President of the Dennison Mfg. Co., Framingham, Mass., is widely known as a progressive employer and served on President Wilson's National Industrial Conference. He urged that as fast as solutions of industrial problems are approached Taylor principles be applied to other problems.

In a paper on "The Necessity of Planning in Administration," J. William Schulze of the J. William Schulze Co., New York, pointed out that planning is needed just as much for the president's job as for the machine operator's job. Too many factories, he declared, are carrying on production on the basis of orders coming in day by day. This results in peaks and slackness, over-production of some lines and shortages in others, price fluctuations, ill-will of the trade and similar troubles. Based on analysis of all factors rather than on guesses, the methods of planning 3, 4, 6 and 12 months ahead were described. Planning should be extended to future developments and to anticipation of profits. The three essential factors are, (1) Coordination between future plans and policies of business and current operation; (2) close interfunctional relationship between operating plans such as production and sales and capacity, and (3) profits and financial stability must be planned for, these being the two objectives of business.

An important phase of the planning of factory operations, "Balance of Work," was described by William D. Hemmerly, resident engineer, The Thompson & Lichtner Co., Boston and New York. By its means the management is enabled to ascertain accurately, constantly and instantly the condition of the plant insofar as work ahead is concerned. It keeps the departments balanced and coordinated instead of allowing one to run ahead of the other. It helps to keep operations as close to capacity as possible; permits better delivery promises and selling policies; employment according to needs, and timely provision of tools, etc. To carry out this function it is necessary to ascertain and maintain statistical information on capacity of all machines and work places, employees and tools. Three mechanisms for this work were described sorting trays, index visible and hook planning board.

How an industrial community has coordinated its facilities for serious study of problems and for cooperative action for progress was told by Henry T. Noyes, General Manager, Art in Buttons, Inc., in an address on "Administration in Rochester." Although turning out a diversified line of products including men's clothing and occessories, shoes, cameras, technical instruments and machine tools, all the prominent manufacturers of the city have organized to work out basis principles of all industry which would be of practical help to each of them. The purpose of the work is industrial progress, not as demonstrated in one "show plant," but progress in which all the industries of the community rise together. Ten years ago fifteen executives representing the principal industries met together once a week and began the study of labor turnover, wage rates and similar questions. Finally in 1914, the Industrial Management Council of the Chamber of Commerce was organized and the industries assessed in proportion to the number of employees in order to provide the large sums needed for expert investigators and executives. The Council is divided into groups including those for managers, superintendents, employment and service men, production men, cost accountants, and office managers. During the war all industrial facilities of the city were coordinated so that there was no bidding by manufacturers for labor, and workers were "drafted" from the plants for war tasks.

William O. Lichtner, Thompson & Lichtner Co., presented an important paper on "The Promulgation of Standards by the Taylor Society." He urged a systematic pooling of the knowledge and experience of the members of the Society. He submitted the beginning of a dictionary of standard terms with the aim of eliminating the present confusion. He urged the standardization of organization plans with clear definitions of the functions of business officials. He formulated basic policies for bonus payments and base wage rates.

How manufacturers are losing production because of improper factory lighting was demonstrated by Ward Harrison, well-known illuminating engineer of Cleveland. In a paper on "The Necessity for Standards of the Relation Between Illumination and Output," he pointed out that tests in factories had shown that many manufacturers are saving $1 in improved lighting and wasting $10 in production. Increased production amounting to from 10 to 20 per cent have followed lighting betterments. He said that night shifts were inefficient partly because of poor lighting. In plants averaging 100 sq. ft. of floor space per employee the cost of good artificial lighting per foot candle supplied is usually not over 0.1 per cent of employee's pay during the period. In discussing this paper, W. H. Leffingwell of the Leffingwell-Ream Co., showed charts which plot lighting intensities on every square foot of an office or factory by different colors.

"Can Industrial Democracy Be Efficient?" This question which is facing many industries in which workers are demanding greater participation, was answered by significant facts from the experience of the men's clothing industry in Rochester. This industry, which is the most highly organized in the country in its industrial relations was described by Dr. Meyer Jacobstein, labor manager, Stein-Bloch Co. A strong organization of manufacturers, the Clothiers' Exchange, and a strong union of workers, the Amalgamated Workers of America, are cooperating for law and order, improved production methods and greater efficiency in the industry. After a year of operation the "Rochester Plan" shows higher standards of production, decreased labor turnover, operation uninterrupted by strikes and more satisfied workers. The indus-

try employs 15,000 to 20,000 workers and where a year ago only 25 per cent belonged to the union, now 90 per cent are members. And yet, according to Dr. Jacobstein, wages are lower by 25 to 50 per cent than they would have been had there been no union, because the union has a stabilizing effect on wages which would rise owing to labor shortage. The plan consists of the representation of the employers by "Labor Managers" assisted by employment managers, production men and time-study men; and the representation of the workers by shop chairmen and a union manager. Disputes are settled by an arbitration court presided over by an impartial chairman whose salary is paid by both sides and whose decision is final. This industrial democracy plan is working effectively because it is training leaders from the rank and file of workers; it has the full consent of the workers; it is educating the workers to the value of technical efficiency and scientific management, and it is putting the industry on a fact basis. A number of labor managers for other employers gave further evidence as to the success of the plan.

"The Worker's Reaction to Scientific Management" was the subject of an interesting address by William R. Leiserson, chairman of the Labor Adjustment Board of the Rochester Clothing Industry and during the war connected with the Government's industrial activities. He declared that labor as such was not opposed to scientific management or to improved production, but that, expressing a basic human attitude, it is afraid of change. Before scientific management can be installed, he said, it is necessary to educate the workers and explain to them the whole truth. The purpose of management, he declared, is to get results not to assert authority. The psychology of the workers must be studied, understood and taken into consideration. He said that the workers know what a fair day's work is and that standards should be a combination of their ideas and those of the management—both sides having experts to represent them. Many workers are not opposed to piece-work if they have a strong union to protect them from rate cutting. If the workers have a share in responsibility of distributing the total wage bill of the industry, as in Rochester, they see that wages are fair. He said more responsibility in management is necessary.

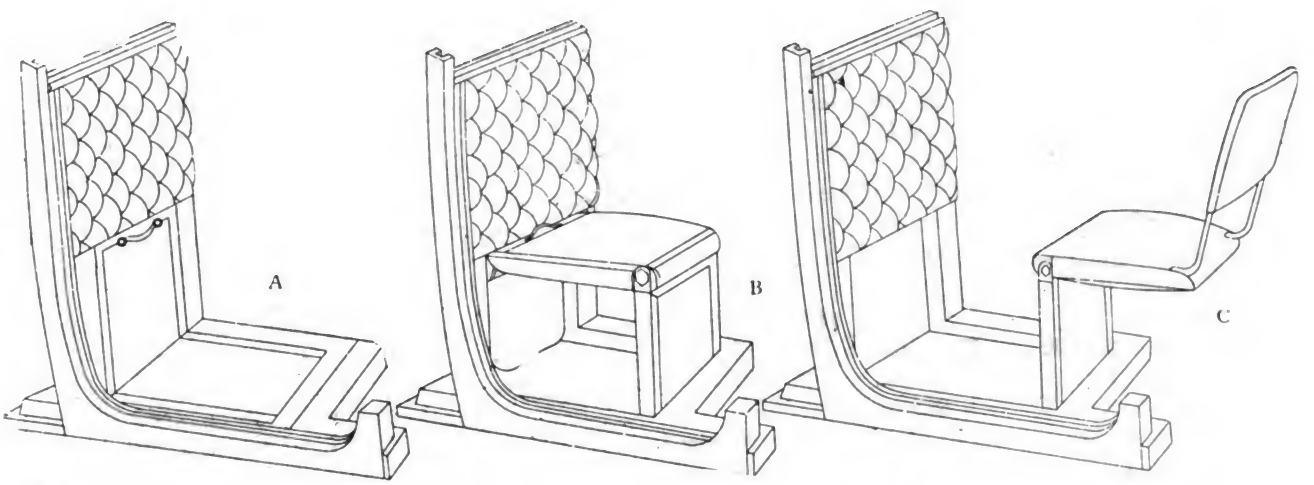
The afternoon of May 8 was devoted to nine round table conferences on the following subjects: Coordination of sales and production; scientific methods applied to sales operations; planning, routing and control of work in process; standards of performance (including time cards, and daily labor inventory. The most important conclusion reached was that Taylor methods must be applied to sales work and a number of prominent manufacturers and sales executives are to have further conferences in the near future.

New French Folding Seat Very Ingenious

The folding seat has long been a problem, especially in the enclosed car where the passengers expect and buyers demand something neat in appearance as well as rigid and substantial in construction. A French design of folding seat, as pictured herewith, seems to have these desirable qualities, as well as an ingenious form which permits of several variations.

As shown at A, the seat is folded down out of the way, not in use, the upholstering at the left representing the partition between the driver's and the passenger's compartments. When a temporary seat is desired, it can be drawn up to the position shown at B. In this position the person using it is riding backwards and using the upholstery of the front of the compartment as a seat back.

In the normal, or full open, position as shown at C, the seat opens out in the usual manner and provides a lazy back which is upholstered, as well as leg room in front, for a passenger riding in the usual position, that is facing to the front.



Barthelemy Folding Seat which is shown closed at A, opened with the back to the route at B, and opened facing the route at C

The sketches are reproduced from Moniteur de la Sellerie, a French publication, which gives the name of the inventor and constructor of this seat as Barthelmy.

Exports for February, 1920, included 2,889 commercial cars and chassis, worth $4,130,468; 11,221 passenger cars and chassis worth $11,604,622; 3,449 motorcycles valued at $920,403; 3 airplanes worth $44,000 and parts valued at $6,494; magnetos, spark plugs, etc., worth $251,876; tires and tubes worth $4,277,969; gas, gasoline and kerosene engines amounting to 10,222 worth $3,456,623, and engine parts exceeding a million dollars' worth.

A tractor manfacturer hid automatic counters inside of a tractor which he sold, and at the end of a year called it in for overhauling. The machines indicated the equivalent of 60,000 miles, while enough fuel had been consumed to drive a motor car 120,000 miles at the rate of 40 miles an hour.

Helpful Hints for Designers and Draftsmen

Influence of Molybdenum on Chrome Steels

Of late a great deal has been heard of molybdenum and its influence on other steels. During the war there was a great scarcity of tungsten and other alloys, and an investigation into the merits of molybdenum proved that it will replace many of them acceptably. Moreover, from a selfish standpoint, it is obtainable in the United States in large quantities.

Among the uses for which it is said to be particularly useful is as an addition agent in chrome steel. When used in this way it is said to increase the elastic limit to a more marked degree than would the further addition of chromium, but with the most important difference that the brittleness is not increased but actually decreased, the greater toughness being shown by the higher elongation and reduction of area.

A chrome-carbon steel analyzing as indicated, properly heat treated to develop its best "balanced" properties, showed the following:

Carbon	Manganese	Chromium	Molybdenum
0.27	0.63	0.99	None
			(1 in. round)
Elastic Limit	Tensile Strength	Elongation, Per Cent.	Red. of Area, Per Cent.
130,000	139,000	16.5	58

Upon substitution of part of the chromium by molybdenum the steel developed the following properties:

Carbon	Manganese	Chroiumm	Molybdenum
0.26	0.64	0.76	0 31
			(1 in. round)
Elastic Limit	Tensile Strength	Elongation Per Cent.	Red. of Area, Per Cent.
142,000	151,000	18.5	62

Even where no higher physical properties are required or desired, the certainty of the results, the increased machinability and the other commercial shop practice economies materially outweigh the increased cost of the addition of molybdenum to the steel.

From an automotive standpoint the increase of almost 9 per cent. in tensile strength when combined with 12 per cent. greater elongation is most valuable, especially when translated into reduction of weight permissible by keeping the strength equal but using smaller sections. On this basis, it should be possible to take between 60 and 100 pounds weight out of a 2,600-2,800 pound car.

New Form of Rivet Produced by War

Among other things which our engineers found susceptible to improvement when speeding up the industrial machinery during the war was the rivet. To the layman, it might seem that a rivet which is going to be heated red hot and then pounded into place might equally and indifferently be any shape at all, that the process of heating and pounding would make it fill the hole. But this is not the fact.

The ordinary rivet has a finished head on one end, and is headed only on the other after going into the hole. The flow of metal from this second end fills that side of the hole all right enough; but on the side of the prepared head, from which there is no flow of metal, there is a tendency for the hole not to remain quite filled, as indicated in our cut. So the efficiency men who had responsibility for the production of our shipyards proceeded to design a rivet which would fill its hole completely under the gentle ministrations of the machine. The result is a rivet which has, on its prepared upper end, only enough of a head to prevent it from falling through the hole and out the other side. When this is inserted and the riveting gun put into action against it, there is a flow of metal from both ends of the rivet into both ends of the hole, and the hole is accordingly filled tight.

Heretofore, in large constructional work, it has been necessary to ream the rivet holes so as to have a perfect fit for the rivet. With the bulb-head rivets such precautions will not be necessary because the rivet will be made to fit perfectly by the pounding of the riveting gun.

Another interesting development in riveting science is seen as a natural consequence of this. Rivets on the finished articles must show heads of various styles and sizes; so under the old system it was necessary to carry in stock a variety of rivets. Now however, the only thing the stockkeeper has to keep track of in rivets is the size of the shank, for with the head formed during the process of driving the rivet, the single shape takes care of all demands.

Possible Method of Fusing Tungsten Claimed

Most of us are familiar with the tungsten filament electric lamp, but few are aware that the filaments which give so effective a light are made from metal without ever having been fused. The melting-point of tungsten is about 3000° C. (5432° F.), a temperature which, it need hardly be said, has been beyond that attainable in any ordinary metallurgical furnace. A method of actually fusing this refractory metal has now, it is said by a German authority, been devised by a Berlin engineer, which will permit of the metal being cast in any desired form, and subsequently being worked into any malleable shape including wire for electric lamps. Incidentally it would appear that tungsten carbide will also become available, and as this carbide is practically as hard as the diamond—the difference being only as 9.8 to 10—it will be used in future for those numerous grinding and cutting operations which can only be effected at present by the diamond. The further development of this new process will certainly be followed with much interest in many quarters.

Power from the Wind at Low Cost

Ordinarily a person does not think of the wind as a source of power, yet when analyzed carefully, it is found that the ordinary windmill or wind engine is a producer of power at very low cost. The installation or first cost of a wind engine is approximately the same as for a gas, gasoline, or oil engine plant to do equal work. Consequently, the advantage of the wind engine lies in its cost of maintenance, which is very slight, practically nothing Moreover, the wind engine reduces the amount of attendance necessary.

A wind with a velocity of at least 5 to 6 miles per hour is necessary to overcome the friction of a wind engine, and when the wind increases to about 25 miles per hour,

the limit is reached at which it is safe to allow the machine to continue at work, when the governor comes into action and turns the head so as to present the edge of the wheel to the wind instead of its circular face. Although it has been stated occasionally that it is necessary to allow for a possible dead calm extending over eight or nine days as a maximum, it has been found from observations that have been made that during a period of three years a total of only four days and three hours of absolute calm were recorded, and at no period were there more than five consecutive days when the velocity of the wind did not rise above 10 miles per hour. From another series of observations lasting over ten years, it was found that during the one year of least wind there were only eight occasions upon which the average hourly velocity was less than 6 miles per hour on three consecutive days. It must be noted that this does not imply that during such days the wind did not rise above 6 miles per hour, and it is probable that a machine which could have been actuated by a 6-mile wind would have been at work part of the time. The strongest winds and the fewest calms occur in winter; consequently, the average velocity of 15 miles per hour is available for eight hours per day.

The statistics available of daily wind are useful, but too much reliance should not be placed upon them for any number of hours of daily work. Even over short periods the wind does not blow at a constant velocity, and therefore it is wise to assume a total working period of, say six to eight hours per day of twenty-four hours.

The efficiency of a wind engine based on the number of square feet of annular sail area decreases with the size of the wheel. For ordinary work the most efficient sizes are from 8 ft. to 12 ft. Over 12 ft. the efficiency falls off very rapidly, and when a diameter of 20 ft. or more is considered the cost becomes so high and the efficiency decreases to such an extent that mechanical power may prove the better proposition, but at the same time wind engines are used—and used profitably—up to a maximum of 40 ft. The peripheral or rim speed of revolution depends directly upon the velocity of the wind and is independent of the size of the wheel, consequently in any particular wind the number of revolutions of a 24 ft. wheel would be only half that of a 12 ft. wheel. The power given out by the larger wheel would be greater, but the low velocity would practically eliminate the effectiveness of the kinetic fly-wheel action, which is such a valuable asset in the smaller sizes.

The wind is such a valuable factor that the only reliable means of ascertaining the power of a wind engine is to measure the work done after its erection. There are several formulae, but calculations resulting from them cover such a wide range that they are not of much practical use. It is best to get a good engine of suitable size from a good maker, and to consider only the average result obtainable.

The velocity of the wind increases with the height above the ground, so that by doubling the height of the tower nearly twice the power is obtained. It therefore becomes a question between a small mill and a high tower or a large mill and a low tower, but owing to the difficulty and danger of mounting the tower, mills are rarely placed higher than about 50 ft.; a height of 40 ft. being the usual maximum. A rule sometimes given is that the height of the tower should be three times the diameter of the wheel. Obviously, mills are most efficient in exposed positions where the force of the wind from any direction is not baffled by trees, but at the best they are large, expensive structures for a small duty. The efficiency depends so much on the workmanship and design that it is useless to buy a cheap machine.

German War Expedients With Metals

Some of the unusual and unique metallurgical expedients to which the Germans resorted during the war to obtain copper from its alloys and also tin and other metals as well as the substitution of electrolytic iron for copper are recounted for the first time by U. Engelhardt in the Electrotechnische Zeitschrift. Extracts are as follows:

The dearth of copper has helped various other metals to the front; that it would also set up an, at least temporarily, important electrolytic-iron industry was hardly to be expected. Artillery trials having demonstrated that electrolytic iron could replace copper as material for the driving bands of shells without putting undue stress upon the guns, three large experimental plants for the manufacture of electrolytic iron were started at Leipzig in the Langbein-Pfanhauser works, in Berlin, by Siemens and and Halske A. G., and at Bitterfeld by the Griesheim-Elektron Co. The two companies last named then erected new plants at Munchen and Bitterfeld for 200 tons of electrolytic iron per month; the Bitterfeld plant, however, was not in full working order by the end of the war. The process adopted was that of Langbein-Pfanhauser as further developed by Prof. Fischer, now director of the Coal Research Institute at Muhlheim on the Ruhr; anodes of Martin-iron are electrolyzed in ferrous chloride to which hygroscopic salts are added. Some new electrolytic iron processes, worked out by Siemens and Halske, Schlotter and Estelle were still in the experimental stage at the date of the report, and at present electrolytic iron remains too expensive on the whole.

With respect to copper itself the problem during the war was to obtain a pure copper from the miscellaneous alloys which the mobilization of copper brought in. Several copper refineries were built in Germany and Austria, notably by the Siemens companies. The brass utilized comprised door brasses, candle-sticks, picture frames, taps, crucifixes, etc.; the brass was melted down, the zinc oxidized and the crude copper cast into anodes and treated in the electrolytic refineries.

The requisition of bronzes, largely church bells, followed that of brass. The disintegration of the heavy strong bell metal gave some trouble; the bells were inverted, filled with water and then shattered by exploding cartridges in the water. The bronze was then fused into anodes for electrolysis. Engelhardt does not give particulars, but mentions that the accumulation of stannic acid in the anode mud and in the electrolyte disturbed the electrolysis, and that some copper was first lost and recovered contaminated with lead and other impurities; those difficulties were, however, eventually overcome.

The recovery of tin was another difficult problem. Germany possessing hardly any tin ores, the stannic anode mud had to be reduced to tin, and special attention was further paid to the recovery of tin from bushings, and it is said that they have been very successful, and that some works have also managed to economize tin by adopting electrolytic processes in their tin plating shops.

New and Improved Ideas in Body Finishing

Troublesome Specks in Varnished Work

This trouble is as old as the art of varnishing itself. It it no respecter of surfaces, conditions or men. It is common to all shops and all seasons, although of course, more common in some shops than in others. But no shop is entirely exempt from visitations of the trouble. There are several causes which generate specks in varnish. First of all the specks may have originated in the coats preceeding the varnish. Thorough rubbing of the surface with water and pumice-stone will remove the specks provided there is sufficient body of varnish to permit rubbing it until these specks are brought down.

Specky varnish may be caused by opening the container and exposing the varnish to the air and whatever dust or dirt is floating about the place. They may come from the dust and dirt in the room at the time of varnishing, and during the period that the varnish remains tacky following its application. The trouble may be due also to a varnish not sufficiently matured or to some technical error in manufacture. Another cause and one which during many years of close observation and experiments experts have determined to be correct is this: "High-grade varnishes absorb moisture from the air very readily, and further tests have shown that this moisture forms with the turpentine a crystalline hydrate, which separates in small grains, having an appearance very similar to sand. It is these crystals which constitute the specks in the varnish as it is spread over the surface. Specks from this source cause extra trouble on the warm, moist days of summer when the atmosphere is saturated with moisture. Upon such days the varnish absorbs an increased amount of moisture, and this moisture acting upon the turpentine medium in the varnish causes the specks to appear. The pervention of these specks in varnish is, as a rule much easier than the cure. An immature varnish, or one not exactly ripe at the time of its receipt, develops specks plentifully. Such a varnish, if stored for several months following its receipt, will settle and cure out, and by a natural process of chemical change, eliminate the cause which produces this trouble.

The use of a dirty brush is often a fruitful source of varnish specks. No brush, dirty, or in a condition to distribute dirt or specks upon the surface, should be used in varnishing. A new varnish brush should first be broken in for applying rubbing-varnish coats, and during the course of this work its condition should be noted from time to time, and as soon as the loose dirt has been washed and forced out of the brush it can be taken over for putting on finishing-varnish coats. There is, perhaps, no absolutely complete method of preventing specks in varnish, but by a thorough system of surfacing, giving each coat the attention due it, and by providing suitable quarters in which to apply the varnish and give it the proper protection during that critical time when it is drying free from dust, the matter can be very well taken care of. In the shops where a system of water-washed air is forced into an apartment absolutely clean, and invariably maintained clean, it is possible to so take care of this trouble that finishers may no longer be disturbed by it.

In this day of the vacuum cleaner and of superior methods of maintaining cleanliness in the varnish room, it should be easily possible to reduce this trouble of specky varnish to the minimum. By the exercise of expert skill and knowledge in handling and taking care of the varnish, and in preparing the surface for its reception, ninety per cent of the cases of specky varnish can be eliminated, which means a finer and more durable finish.

Battleship and Similar Grays

Probably one of the most, if indeed, not the most popular grays used in automobile work today is battleship gray. Possibly sentimental reasons, resulting from the European war situation, are responsible for the present existing popularity of this particular gray. However, aside fro all these reasons the fact that this gray is a very durable color, easy to maintain, and in no respect objectionable from a "loudness" of color, accounts in large part for the wide spread use it now enjoys.

French gray, a soft, warm, pleasing gray, is also much thought of at present, and many cars dressed in this color may daily be seen on city boulevards. Automobile gray, cadet gray, and 20th century gray are also very much in evidence in New York, Boston, Philadelphia and Chicago. They are for the most part, cool, quiet, neutral colors, neat and effective, and while giving the car a "dressy" appearance they do not unduly attract attention.

Nevertheless, battleship gray holds chief public facor and when readers of this department are approached for the selection of a gray they can commend this color as one approved by the very elect, and suitable for any porpose,

Lettering Motor Trucks and Wagons

Continuing the remarks in the last issue relative to lettering, the best way to start a lettering job is to pounce the surface with whiting or rub it with pieces of sliced potato, the white of an egg, or with anything composed in large part of starch, glue or albumen, to prevent gold leaf sticking to it. In the great majority of cases whiting or ordinary charcoal will suffice to prevent this trouble.

In using gold leaf always employ the best grade. Double X, deep, gold leaf quoted at from $7.25 to $7.50 a pack probably much higher at this writing, is always a finer appearing job and a better wearing one. Such a leaf can be varnished over several times in succession and the surface can be cut in with color, leaving this gold leaf work intact and largely in its original purity of shade. At any rate, gold leaf looks its royal self under repeated and successive revarnishing and painting repairs. An inferior grade of leaf generally loses its lustre before the carriage, or wagon, or car, is shopped for its first repainting or revarnishing. It is obvious, therefore, that from any point of view, gold leaf of prime quality is cheaper than the "just-as-good cost-you-less kind."

Before lettering on glass clean the surface with a mixture of two-thirds denatured alcohol and one-third pure water. Saturate a woolen cloth with this solution and then dip it into good bolted whiting. Smear the glass in solidly with this alcohol-water-whiting mixture and upon evaporation of the alcohol and water wipe dry with successive pieces of clean cloth free from lint.

A size for gilding on glass should consist of either gelatine or ising'ass (a product of the air-bladders of the

sturgeon). Put five pieces of the size of a kernel of coffee of either of the above materials into a saucepan until half of the water is boiled away. Then add enough cold water to make the saucepan full.

Springtime Hints for Motor Car Painters

This is a season of the year when all hands are rushed. Business has increased wonderfully during the past few weeks as it always does about this time of the year. Carriage owners who, a month ago, could not be induced for love or money to send their work to the paintshop are now almost fighting for a chance to get their work placed for prompt handling.

It is a good plan to get as much of the heavy repair work as possible out of the way before the real spring rush of business begins. If this has been done, only a small volume of heavy painting repair work is now going through the shop. This is as it should be. With this class of work for the most part well out of the way the painter can take hold and successfully handle about all of the touch-up and varnish jobs that he can get started his way.

This class of work can be handled as a rule in large volmue because it can be handled quickly and rapidly turned into money. The jobs that clog up the shops are those which require a considerable length of time to paint and finish; and after finishing, a considerable length of time is taken in getting the work out of the shop and into the possession of the owner.

To touch up and varnish the carriage or automobile carries a number of apparently simple, but at the same time, exceedingly important operations. As soon as the work is brought to the shop all parts that are to be removed should be taken off the job and carefully labeled. All grease and oily substances should be carefully removed from the surface, after which, the varnish should be rubbed sufficiently to lay down the gloss and fit the surface for revarnishing. The next step consists in matching the color after which the work should be carefully gone over and all surface defects touched up with a matched color.

Touch the work up carefully and confine the color to the exact surface defect. Put the color on smoothly. Never daub it on. On the contrary lay the color as smooth as possible. The next step consists in washing up the surface preparatory to finishing. This is one of the very important steps in the work. Use plenty of clean, fresh water. Use two pails, two soft fleece wool sponges, two chamois skins, and two wash brushes or water tools. Keep one set of wash tools for the final washing.

After washing proceed to finish the body of the job, later taking the running parts in hand following a treatment closely allied to that given the body. Some of these touch-up and varnish jobs will be found to require an extra coat of varnish. Where the surface is considerably traced with fine cracks, it will be necessary to apply an extra coat of varnish which coat should be rubbing varnish.

It not infrequently occurs that this surface condition does not reveal itself until the work has been rubbed with pumice stone and water. If the price made for the work is based upon one straight coat of varnish, the painter will find it advisable to notify the owner immediately or the party in charge of the work vested with authority for making contracts. Usually such notification will result in an order for the extra coat of varnish.

All touch-up and varnish work before released for service should be carefully inspected and defects made good by carefully touching up. This practice results in balancing up the work and giving the finish throughout more uniformity.

Polishing the Flat-Finish Parts

Door jambs, rabbets, edges and all parts of the car interior, or parts classed with the interior which are handled to a greater or less extent, had best be finished without gloss—given in fact, what is known as a rubbed and polished finish. This same advice applies to similar parts of closed horse-drawn carriages such as broughams, landau etc. These parts may be brought up with rubbing varnish, over the color coats and carefully rubbed with pumice stone and water and then flowed with a coat of polishing varnish. This varnish when thoroughly dry, should then be rubbed, first with water, using a varnish polish for this work. Of these polishes there are a number of excellent ones on the market.

If, however, it is preferred to use a shop-made polish here is a formula which the writer is in a position to vouch for: sweet oil, ½ pint; vinegar, ½ pint; denatured alcohol, ½ pint; turpentine, ½ pint, and gum Arabic, 3½ tablespoonfuls. Dissolve the gum Arabic in the vinegar and then add the other ingredients. The process of polishing consists in using enough clean wadding to make, when tightly rolled in the hand, a ball as large as a hen's egg. Mix the cotton into the mixture frequently until it becomes thoroughly saturated—thickly coated or encrusted on the rubbing side of the ball. Keep this ball in one position and rub hard and firm, maintaining a sharp friction. When the pad sings and creaks under the pressure it is doing its appointed work. This high brilliant polish finally cleaned off with a bit of alcohol tossed upon a cloth, will stand handling without injury—and herein lies its advantage.

Missouri Has 1 Tractor to Each 40 Farms

Statistics collected by a field agent of the Dept. of Agriculture, last fall, and continuing to Dec. 1, indicated that there was a farm tractor in that state for each 40 farms, a total of 3,332 tractors of 60 different makes.

The census shows that on June 1, 1919, there was reported on Missouri farms, 3,332 tractors and since that time sixteen companies have delivered to dealers and farmers 2,700 or more machines, or a total to Dec. 1, of more than 6,532. One large concern shipped in 1,100 tractors since that time. Logan believes that a perfect resurvey would doubtless locate not less than 7,200 tractors in the State.

The largest number of tractors, continues the report, are found in the northwest, west, central and east Missouri, with Nodaway, Platte, Callaway and Lincoln Counties, each having more than 100 in operation on June 1. According to dealers, Carter, Douglas, Ozark, Shannon and Taney counties have no tractors used solely ior farm purposes. Those makes of tractors reported as having sold over 200 in use on farms at that time were the Avery, Fordson, International, Mogul, Moline and Titan.

There are 27 cars, three motorcycles and two trucks in the province of Taiwan, China, all of American manufacture, except one Italian car and one English cycle.

The New and Unusual in the Automotive Field

Harrington Special Horizontal Drill for Oil Holes in Crankshafts—Curran Radiator Built on New Principles—Nuttall Steering Unit for Tractors

It will be the policy of Automotive Manufacturer (as in Automotive Engineering) to present on these pages each month some car, truck, aeroplane, boat, tractor, engine or other unit which presents unusual and decidedly different engineering features

Harrington Drill for Crankshaft Oil Holes

One of the big problems of crankshaft production is now and has been that of drilling the oil holes and many an American motor shop has a homemade drill constructed for this purpose. These very small sized holes must be drilled at an angle, coupled with the fact that the shaft itself is an odd shaped piece hard to handle and even harder to hold in any form of vise or jig, has complicated the matter.

A new machine which has been developed and is now being placed on the market by Edwin Harrington, Son & Co., Philadelphia, Pa., seems to solve the problem. This is called the No. 130 horizontal drill, and is shown complete in Fig. 1. Fig. 2 shows one if the sparate heads and Fig. 3 illustrates the method of handling the work in two stages.

This machine is intended particularly for drilling oil holes from main bearings to crank pins for four cylinder engines, but the flexibility of design, due to each spindle head being a self-contained unit makes it adaptable to a wide variety of uses. The base can be made in any shape and the number of heads and their location on the base can be varied at will.

In regular machines for ordinary crankshafts, four individual spindle heads are used, each with its own driving motor and feed control. They are mounted in pairs on plates which permit variation of distance between spindle centers, variation of distance between the spindle nose and the work, and change of angle. The length of the spindle feed is sufficient to drill all the way through the average crankshaft, but as two holes usually intersect at the center bearing, and as long drills are objectionable, it is better to divide the cut by drilling successively from two sides as illustrated by the attached diagram. After the holes have been drilled half way from one side, the crankshaft is reversed end for end, which brings it into the proper position to have the holes completed from the other side, meeting those first drilled in the center of the cranks.

Fig. 1. Assembled Harrington No. 130 crankshaft oil hole drill

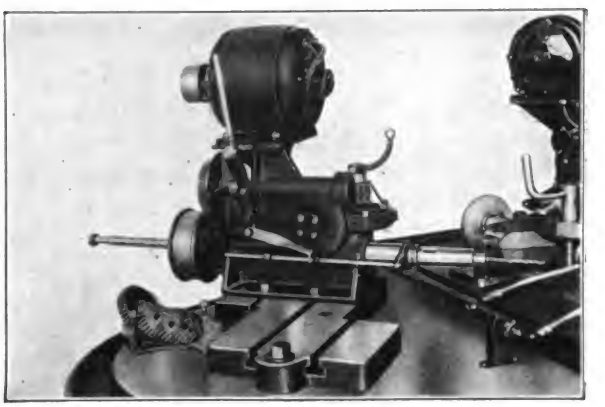


Fig. 2. One of the drilling heads of the Harrington Crankshaft Driller

The spindle heads are made only for individual motor drive to avoid any difficulty of providing for a belt drive from a single source in their various positions Belted connection is made from the motor to the spindle pulley to allow a flexible drive, with the tension taken by ball bearings on the pulley hubs to relieve the spindle from any strain. As only a single spindle speed is required, the motor can be of the constant speed type, either direct or alternating current winding. Permanent changes of speed can be made by changing the size of the motor pulley. The spindle runs in a long sleeve, having a bearing for its full length, which is advanced out of the head by its steel rack and pinion for spindle feed. A ball race at the forward end takes the drilling thrust and a flange attached to the end of the sleeve carries the trip rod. A hole is drilled for the entire length of the spindle to provide for the use of oil feed drills if desired.

The feed is driven from the spindle pulley by spur gears so arranged that the driven gear may be changed to get different rates of feed. Two pairs of triple thread steel worms and bronze gears, each with a ball thrust mounting drives the rack pinion. A clutch is provided between the spur gear and the first worm to disengage the power feed either manually or automatically at any predetermined point. Also a lever on the upper end of the rack pinion operates a clutch for connection with the worm gear and provides means of moving the spindle at one handling.

The plates upon which the heads are mounted are pro-

vided with T-slots to allow movement of the heads to change the distance between centers, and are located on the table by a center stud with holding-down bolts in slots at the ends. Provision is made for locating a taper dowel pin in a separate hole for each size crankshaft. The location of the plate on the table and the shape of the table itself are subject to change to suit the job under consideration.

The table is made in a convenient shape to allow easy loading of work and has sufficient space to receive a jig of nearly any size. The top has a flat surface with a gutter all the way around, and ample ribs are provided underneath for strength. The jig can be easily located on the table by an inserted key with holding-down bolts and dowels for endwise location.

The tank and two pumps for cooling liquid make a separate motor driven unit to be placed on the floor beneath the machine. The end pump (hidden by the front leg) delivers oil at the point where the drills enter the bushings and the pump in the center is provided for a supply through flexible tubes to a fitting on the outer end of each spindle when oil feed drills are used. (This supply through the hollow spindles was not in use when the illustration was made.)

The work holding fixture and the motors are not included with a machine unless specially mentioned.

The principal dimensions are: Drilling capacity in steel ⅜-in. holes. Minimum distance between spindles, 7⅜ in.* Maximum distance between spindles, 10½ in. Traverse of spindle, 8 in. Height of spindle above table, 4¾ in.* Height of table above floor, 2 ft. 7 in.* Size of key in table for locating jig, ⅝ x ⅝ in.* Diameter of spindle through sleeve and pulley, ¾ in. Taper in spindle, Morse, No. 2. Diameter of oil feed hole through spindle, 5/16 in. Spindle speed, 1000 r. p. m. Feeds per revolution, .002, .003, .004, .005 in. Size of each motor, 1750 r. p. m. Floor space, 5 ft. 9 in. x 4 ft. 0 in. Height over all, 4 ft. 4 in.* Weight without motors, 2150 lbs. Weight with motors, 2415 lbs.

*These dimensions can be varied.

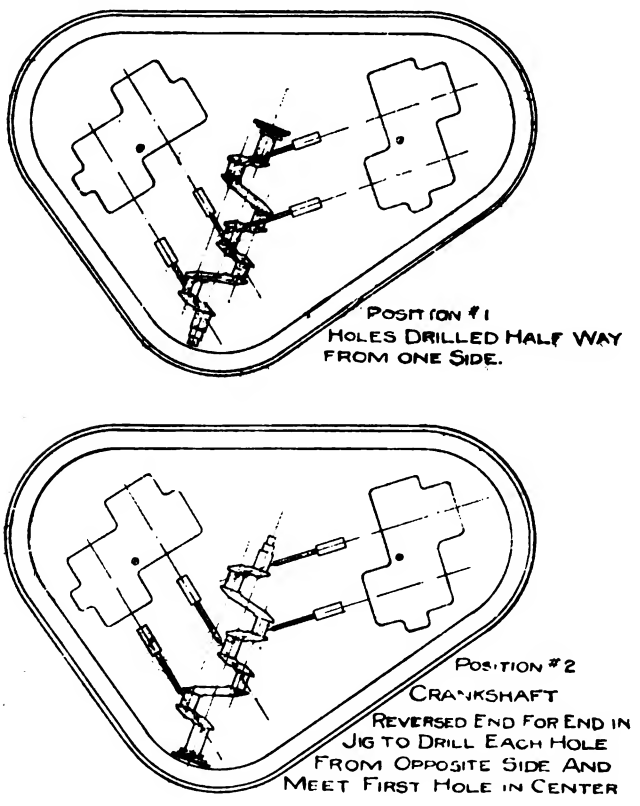


Fig. 3. Sketches showing method of handling crankshafts in Harrington machine

The New Curran Radiator

A new thermostatic control radiator for small cars especially Fords—the invention of Dr. E. T. Curran of Detroit—seems to be the solution of one of the Ford owner's problems—radiator trouble—the problem of motor overheating and damage by freezing.

Dr. Curran originally designed his radiator to fill the Government's wartime demand for an absolutely leak-proof cooling system for the 400 H. P. Liberty motors used in DeHaviland 4 airplanes. His invention was accepted by the Government in face of all competition. The war over, Dr. Curran devoted his energies to perfecting the radiator for motor cars and trucks, and has had instantaneous success with it in all makes of automobiles—but especially with Fords where the need is greater.

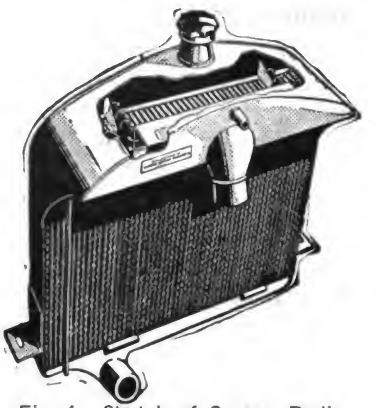


Fig. 4. Sketch of Curran Radiator showing thermostatic control device

The radiator shown in Fig. 4 has two outstanding new features: thermostatic control and diagonal draft. The thermostatic control is a simple self-adjusting device which regulates the circulation of water—allowing more or less to circulate as is needed. The water itself decides how much or how little additional cooling is needed. The upper tank of the radiator is divided on opposite sides by vertical plates of varying levels. Since heat expands water, when the end reservoirs are too warm, the water promptly rises—spilling into adjacent central sections. When speed is reduced, the water automatically drops back to the smaller circulation. The motor is thus run summer and winter at an even temperature of around 170 degrees (the proper heat for water returning to the motor from the radiator).

Beside the simplified thermostatic control, the Curran has another unique feature. The core of the radiator is so constructed that air passes down through it at an angle of 30 degrees—with a "down draft" directly onto the top, front and sides of the engine. This angle of fin surface and the increased air pressure caused thereby, increases the cooling power at least 100 per cent. Increased cooling power is necessary as a gallon of water turns over 2½ times oftener in the Curran than in the usual radiator—due to the larger, freer water passages. The water thus does double duty and to allow this quicker motion of water more than ordinary cooling power is required.

The Curran will stand continuous freezing because of its "elastic" core construction which allows for expansion of water on freezing. As a test of its worth, a stock radiator was frozen solid eighteen successive times without the least injury; and a car equipped with it was driven for 10 miles in low gear through mud up to the hubs without the radiator boiling or the motor showing the least indication of overheating.

A company has been formed, the Curran-Detroit Radiator Co., and is now operating a factory in Detroit for the manufacture of this invention in large quantities.

New Nuttall Tractor Part a Standard Design

A compact, enclosed steering unit manufactured for tractor use exclusively, has recently been placed on the market by the R. D. Nuttall Co., Pittsburgh, Pa.

This steering unit is built to specifications that will answer the demands coming from a great number of tractor manufacturers. It is completely enclosed in a substantial gray iron case with carefully machined bearing surface. and it is assembled in such a manner as to give complete protection to the working prts from dust and oil. Plugged openings affords the means of applying the grease that lubricates the operating mechanism.

The major parts of this unit, shown in Fig. 5, are a steel worm and worm gear, assembled in a way that permits the worm wheel to be turned a fraction of a turn when worn, bringing into use an unworn section of the gear and thus eliminating the comparatively frequent replacements

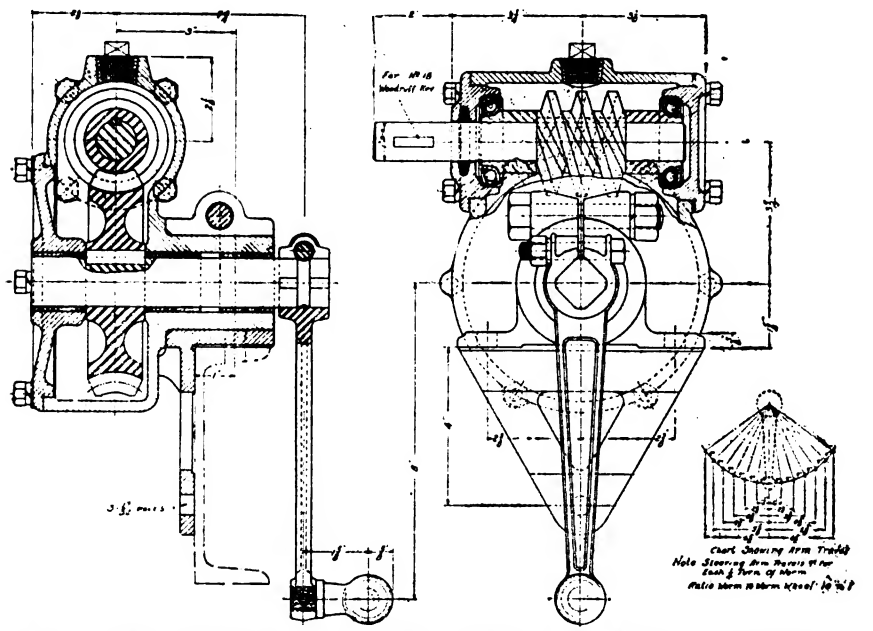


Fig. 6. Constructional drawing of Nuttall Tractor Gear, showing meritorious point in the design

which are necessary with the commonly used worm wheel segments.

The steering arm is a machined drop forging, fitted with a separate hardened steel ball end. This steering arm is fitted onto the squared end of the steel worm shaft which is smoothly machined as shown in Fig. 6 and operates in bronze-bushed bearings, which minimize friction.

The worm shaft is produced from machinery steel and is machined to close limits.

The unit is designed to be operated by a steering column placed at any angle with relation to the frame so that the most convenient location of the steering wheel can be provided for the operator.

By reversing the worm shaft the unit can be made to accommodate either right or left hand control.

A bracket is provided for attaching the unit to the tractor frame and is produced to successfully care for special requirements in tractor designs.

Fermogas, a new fuel, is produced from vegetable matter.

Copper Production Smaller in 1919

According to the Geological Survey, the production of copper in the United States in 1919 was markedly smaller than in 1918, the comparative values being: 1918, $471,-000,000; 1919, $234,000.000.

The figures showing the smelter production from domestic ores represent the actual output of most of the companies for the first 11 months of the year and the estimated output for December. A few companies gave no figures for November, but furnished estimates of the combined output of November and December. The production of blister and lake copper from domestic ores was 1,278,000,000 lb. in 1909 against 1,908,-000,000 lb. in 1918 and 1,224,000,000 lb. in 1913.

The supply of refined copper, electrolytic lake, casting and pig, from primary sources, domestic and foreign, for 1919, is estimated at 1,800,000,000 lb. compared with 2,432,000,000 lb. for 1918 and 1,615,000,000 lb. for 1913.

According to the Bureau of Foreign and Domestic Commerce, the imports of copper in all forms for the first 10 months of 1919 amounted to 346,855,000 lb., against 575,-800,000 lb. for the 12 months of 1918. The exports of pigs, ingots, bars, plates, sheets, rods, wire and like copper products for the first 11 months of 1919 amounted to 496,350,000 lb.; the exports for the 12 months of 1918 were 744,429,-000 lb.

At the beginning of 1919 about 180,-000,000 lb. of refined copper was in stock in the United States. Adding this quantity to the refinery output for the year showed that the total available supply of refined copper was about 1,980,000,000 lb. On subtracting from this total the exports for the last month, and assuming that there was no change in stocks, it appears that the supply available for domestic consumption in 1919 was considerably less that the 1,661,000,000 lb. available in 1918.

Automotive Cities Show Large Gains

From the available figures for the recent census taking, it appear that those cities in which the tutomotive industries is strong, or in which there are many automotive plants, have shown by far the largest gains. Among these may be mentioned Detroit, Cleveland, Toledo, Indianapolis, Wichita Falls and others. The first and last both show more than 110 per cent gain.

Dispacing St. Louis, Detroit has become the fourth largest city in the United States when, according to the report of the Census Bureau, its population was estimated at 993,739, an increase of 527,973 or 113.4 per cent in ten years. America's automobile city has a numerical increase and rate of growth larger than Chicago's and second only to New York's, and outranks Boston, Cleveland, Baltimore and Pittsburgh.

A body drafting school has been started at Flint, Mich., by the Industrial Fellowship League in its School of Automobile Trades.

Black Locust Growing Is Profitable

With the continued demand for all wood products, and the prospects of this continuing indefinitely, it is important as well as interesting to know that at least one kind of wood can be grown at a profit, that is can be planted, grown to maturity within the life of the planter and cut and marketed by him at a profit. By this reference is had to black locust.

Black locust—known also as "yellow" locust —is one of the most profitable and useful kinds of timber of the farm. The wood is heavy, hard, and particularly durable when used in the ground. For use as fence posts, black locust is long-lived and very desirable. Only one other wood gives longer service, namely, osage orange or "bois de'arc," which, however, nowhere occurs in abundance and is so hard that it is difficult to drive staples into it except when it is green.

Black locust grows rapidly and yields good-sized fence posts at an age of from 14 to 20 years, according to the Forest Service, United States Department of Agriculture. A worn-out field in middle-Tennessee which, 20 years previously, had been planted with 1-year-old locust seedlings, yielded fence posts worth $188 an acre on the stump, or $480 at the railroad about two miles distant. This was a gross return of $9.40 an acre yearly on a hillside of fairly good soil which before the trees were set out had started to gully badly. Returns of $5 to $7 an acre annually have frequently been realized on poor, thin, hill land. Good soils underlain with limestone and planted to black locust in the Appalachian and Piedmont regions, from Pennsylvania to Kentucky and Tennessee, can be counted on to yield an average of $10 an acre yearly at the end of from 15 to 20 years.

The manufacture of insulator pins requires large amounts of black locust, for which purpose it is the most satisfactory wood.

In starting black locust, small sprouts with a portion of the root may be dug up and used; or, better, the seed may be sown in the spring in drills in good soil, like onion seed. At the end of the season the seedlings will be from 2 to 4 feet in height and satisfactory in size for setting out. This may be done in the late fall, but the spring season, about the time growth starts, is preferable. In some regions the locust wood borer is almost certain to cause extensive damage to young plantations unless special precautions are taken to keep the trees in a healthy growing condition and the bark shaded by foilage, either from near-by trees, shrubs, or weeds. Information on this insect and methods of its control will be found in United States Department of Agriculture Bulletin 787, "Protection from the Locust Borer."

Strange as it may appear, black locust, although one of the most durable woods when set in the ground, matures early and deteriorates in the tree rapidly if not cut when ripe. Commercially the tree is usually mature in 15 to 25 years.

New Light Alloy Contains Magnesium

Heretofore magnesium has not been used extensively for purposes where mechanical strength is important. Recent developments in the production of alloys of magnesium, however, have opened the way for many applications of this remarkable metal, particularly in automobile and aeroplane construction. In this connection, the attention of engineers is called to a casting alloy recently developed by the Dow Chemical Company of Midland, Michigan, and known as the Dow Metal, which marks a considerable advance in the field of light-weight alloys.

This new alloy has a specific strength of 1.80, combined with a tensile strength of over 20,000 lbs. per square inch. When subjected to a certain heat treatment, this strength may be increased to 28,000-30,000 lbs. per sq. inch. It may be cast either in sand or metal molds. The castings resemble malleable iron in being unusually tough and resistant to shock. While possessing only about one-half the tensile strength of malleable iron, Dow-Metal being only one-fourth as heavy, is really twice as strong for an equal weight.

To illustrate the strength of it the following test was made. A cylindrical casting 3 inches in diameter by 3 inches long, closed at one end, and having walls 3-16 inch thick, was subjected to compression lengthwise. It required 40,000 lbs. to deform the casting and 68,000 lbs. to break it. Before breaking it was compressed 9 per cent. of its original length, and, when rupture occurred it did not fly to pieces but broke along two cracks on opposite sides and extending only two-thirds of its length.

This metal has been tested extensively in pistons for automobile engines, with highly satisfactory results, these tests having been run in several types of engines, over many thousands of miles under all manner of road conditions. Equipped with these pistons, the engine has run more quietly and with less vibration, has quicker acceleration, while about a twenty per cent. increase in mileage per gallon of gasoline has been obtained. At the same time some disadvantages which have accompanied the use of other light weight piston alloys in the past, have been overcome.

The company purposes to develop the use of its alloy in castings for pistons and other machine parts, where lightness is essential. A special research department has been organized to carry on this work, and the staff is engaged in working out the problem connected with the production of castings and with the further development of magnesium alloys.

New Type Storage Battery From Sweden

In a recent issue of Science Abstracts, a new type of storage battery of Swedish origin is described. This appears to be a modification of the nickel-iron alkaline cell as made by Jungner, the chief characteristic being the method of making up the plates from briquettes of active material, which are automatically fed in between two perforated nickel-steel strips. These strips enclosing the active material are manufactured in lengths folded together and fitted into a steel frame. The complete electrode is then put through a rolling process to ensure perfect contact between the active material and the strips. Only a brief inidcation is given of the methods followed.

Two Belgian and two French inventors, working in Paris, claim to have worked out a new process for producing high grade alloy steels in a manner similar to and fully as cheap as the Bessemer process.

Current Automotive Metal and Supply Prices

Despite the resumption of business, recent price cutting has unsettled things all over the country. Retailers who have cut prices have done some business, because there is so much waiting an outlet, but these retailers want first and second hands to cut in turn, and they are reluctant, considering high prices for raw materials, also high and uncertain labor. In some lines, as iron and steel, and automotive manufacturing, the demand is so much in excess of the supply that business continues undiminished, regardless of final price.

General Business

Delivery troubles are the only actual ones, prices being secondary to actual transfer of needed materials. Trend of prices seem to be slowly upward, No. 2 Valley pig having moved up $2 during the month. Refined iron and soft steel are up also. Some plates and shapes have been sold at lower figures indicating price concessions are not far off.

Iron and Steel

July delivery on copper is now quoted at 19c. against the 19.14 which ruled the market for many months. This is only change of recent date. Some Japanese interests have entered the market to resell metal bought some time ago. May sales totalled only 62,000,000 lbs. No change in aluminum situation.

Copper and Aluminum

Transactions have been light, but market for lead continues firm. Leading interest continues to quote 8.50c. N. Y. for early deliveries but outside quotations are higher. Tin also continues quiet. Arrivals at New York to June 8 total 885 tons.

Lead and Tin

Zinc is down compared with last month. It touched bottom on June 4, when price dipped under 8c. N. Y. It stood at 7.95 that day, went to 7.97½ the next day, and has since reacted to 8.15. Antimony is quiet and unchanged. Silver has gotten down into pre-war figures, having touched 81 c. N. Y. early in June, later rising to a little above 90 c. Ferromanganese is easier. Mercury is up again. Speigel is up also.

Zinc and Other Metals

Old Metals These reflect the dullness of the market. Scrap steel is down, and non-ferrous scrap metals.

Chemicals Conditions are less strained, but deliveries are still poor. Some foreign contracts havt been cancelled. Turpentine is lower and can be obtained, other naval stores are easier. Alcohol is now being delivered. Caustic soda and soda ash prices have broken.

Fabrics The burlap inquiry is much better, and prices are firmer, although spot 8 oz. 40's. have sold under 8 c. After a recent week of dullness, the wool market is lower. Yarns and cotton are firm; tire fabrics higher.

Other Materials Rubber is lower than last month, but firm at these prices. May receipts exceeded 27,000 tons, bringing total for five months to 137,000 tons. Last year, figures were 16,000 and 97,000 respectively. Hides are weaker, sales have been very light. Bogotas, 41 less than two months ago, are down to 33, and weak at that figure.

Every effort is made to have the following prevailing prices (compared with last month's) accurate but none is guaranteed. They are obtained through trade sources and may not be realized on small quantities:

	May 1	June 8
Acid, Sulphuric, 66°.....ton	$22.00 —$25.00	$23.00 —25.00
Alcohol, Ethyl, 97 p.c.....gal.	6.00 — 7.00*	6.00 — 7.00*
Alcohol, denatured, 190 proof, gal.	.98 — 1.02*	1.00 — 1.05*
Aluminum, Ingots No. 1 99% pure, carload lots.....lb.	.33	.33
Ammonium Chloride (Sal-Ammoniac) white, granular....lb.	.17 — .18*	.17 — .18*
Babbitt Metal, best grade.....lb.	.90	.90
Babbitt Metal, Commercial....lb.	.50	.50
Beeswax, natural crude, yellow.lb.	..	..
Carnauba No. 1 Wax.....lb.	.80 — .88*	.93 — .95 *
Caustic Potash (85-92 p. c.)..lb.	.30 — .35	.31 — .35
Caustic Soda, 76 p. c.....100 lb.	7.00 — 7.50	6.25 — 6.50
Pumice, Ground (domestic)....lb.	.02½	.02½
Shellac, Orange, superfine....lb.	1.60 — 1.65	1.60 — 1.65
Tin, Metallic straits pig.....lb.	.64	.54
Turpentine, spirits of crude.....	2.50*	2.27 — 2.30
Zinc, Western Spelter.....lb.	.09 — .10	.10 — .11
No. 9 base casks, open.....lb.	.14½	.15

*Nominal

IRON AND STEEL, PIG, BARS, ALLOYS, OLD METAL

Pig, per ton—	Apr. 30.	June 8
No. 2 X, Philadelphia§.....	$47.05	$47.15
No. 2, Valley furnace†.....	43.00	45.00
Basic, delivered, eastern Pa.....	44.80	44.80
Basic, Valley furnace.....	43.00	43.50
Bessemer, Pittsburgh	43.90	44.40
Malleable, Valley	43.00	44.00
Refined iron bars, base price....	5.00c	5.25
Soft Steel—		
¾ to 1⅞ in., round and square..	3.52—5.00c	3.52—5.25c
1 to 6 in. x ⅜ to 1 in.....	3.52—5.00c	3.52—5.25c
1 to 6 in. x ¼ and 5/16.....	3.62—5.00c	3.62—5.25c
Rods—⅝ and 11/16.....	3.57—4.80c	3.57—5.05c
Bands—1½ to 6 x 3/16 to No. 8..	4.22—6.25c	4.22—6.50c
Ferromanganese, 76% to 80% delivered producers' price.....	$250.00	$240.00—250.00
Spiegel, 18% to 22% furnace, spot	62.00— 67.00	70.00— 75.00
Ferrosilicon, 50%, spot, delivered	85.00— 90.00	80.00— 85.00
Old Metal		
Heavy steel scrap, Pittsburgh...	25.00	25.00
Heavy steel scrap, Philadelphia..	24.00	22.50
No. 1 cast, Pittsburgh.....	32.00	32.00
No. 1 cast, Philadelphia.....	38.00	37.00

†Silicon, 1.75 to 2.25. §Silicon, 2.25 to 2.75.
Ferrosilicon prices at Ashland, Ky., Jackson and N. Straitsville, O.

BOLTS AND NUTS

(Discounts are from Nov. 1, 1919)	May 1	June 8
Machine bolts, c.p.c. and t. nuts, ⅜ x 4in.; Smaller and shorter..	35	35
Carriage bolts, ¾ x 6 in.: Smaller and shorter, rolled threads	40— 5	40— 5
Cut threads	30—10	30—10
Semi-finished hex. nuts: ⅝ in. and larger.....	60— 5	60— 5
9/16 in. and smaller.....	70— 5	70— 5
Tire bolts	55—10	55—10

BRASS, COPPER SHEETS, SHAPES, VIRGIN METAL, SCRAP

	May 1	June 1
Copper, Lake, ingot.....lb.	$ 0.19¼	$ 0.19¼
Copper, Electrolytic .....lb.	.19¼	.19
Copper, Casting .....lb.	.19	.19
Copper sheets, hot rolled.....lb.	.29½	.29½
Copper sheets, cold rolled.....lb.	.31½	—
High brass wire and sheets....lb.	.25¼	.25½
High brass rods.....lb.	.23¾	.23¾
Low brass wire and sheets....lb.	.27¼	.27¼
Low brass rods.....lb.	.28	.28
Seamless bronze tubing.....lb.	....	—
Seamless brass tubing.....lb.	.30½	.30½
Old Metal—		.12¼—.12¾
Copper light and bottoms.....	.16¼	.07¼—.07¾
Brass, heavy	.14	.06¾—.07¼
Brass, light	.10	—
Heavy machine composition.....	.18¼	.79 —.80
No. 1 yellow brass turnings.....	.11½	.10 —.10¼
No. 1 red brass or comp. turnings	.16	1.60 — 1.65

CRUDE RUBBER

	May 1	June 11
Para, Upriver fine.....lb.	$ 0.40½— .42	$ 0.37½
Upriver coarse .....lb.	.30½— .32	.28
Upriver caucho ball.....lb.	.32½— .33	.30
Plantation, first latex crepe...lb.	.44 — .45	.38
Ribbed smoked sheets.....lb.	.44½ ..	.88
Brown crepe, thin, clean....lb.	.42	.37

PETROLEUM PRODUCTS

	May 4	June 11
Oil—Pennsylvania Crude	$ 6.10	$ 6.10
Kansas and Oklahoma Crude..	3.50	3.50
Gasoline,Motor,garages,steel bbls..	.28½	.30
Consumers, steel bbls.....	.30½	.32
Lubricating Oil, black, 29 gravity	.28— .35	.28—.35
Cyl. light filtered.....	.90— .95	.90—.95
Dark filtered	.80— .82	.83—.85

Men of the Automotive Industry

Who They Are What They Are What They Are Doing

W. H. McCloud, for 13 years identified with the Buick Motor Co. in its traffic department, and since 1917 as director of traffic, working directly under Walter P. Chrysler, at that time president of the company, has resigned to join his old chief in the Willys interests. McCloud on May 1 became special traffic representative for the whole group, a post made particularly important in the present condition of traffic, and in the big production and shipping programs which are under development at the Willys-Overland and the Willys Corp. factories. McCloud is succeeded at the Buick plant by George C. Conn, who comes naturally to the job from the post of general traffic manager for Buick. A. R. Merrick has been appointed to the latter post.

H. E. Dodge has suceeded to the presidency and treasurership of Dodge Bros., formerly held by his brother John. Other changes in the organization are as follows: Fred J. Haynes, who has been works manager since Dodge Brothers began building complete cars, now advances to the post of vice president and general manager. The board now consists of President Dodge, General Manager Haynes and Howard B. Bloomer, the latter having been personal counsel to the late John Dodge for years. Arthur T. Waterfall, who also has been associated with Dodge Brothers affairs for a long time, is now assistant general manager, while Preston G. Findlay is director of traffic and R. H. Allen director of purchases.

Carl F. Clarke, who before he entered the army, was widely known as general manager of the Michigan Electric Welding Co., has purchased with others, the Monroe Steel Castings Co., Monroe, Mich., and for the present is developing the company's general line of steel castings. The capital of the company has been increased to $300,000, and its production rate is about to be tripled. Allen B. Van Eschen, who has been factory manager for the Michigan Steel Castings Co., has been made treasurer of the company, and placed in charge of manufacture. Clarke himself is president and general manager.

Ralph Murphy, chief engineer for the Franklin Automobile Co., Syracuse, N. Y., will in future act as assistant to John Wilkinson, vice president. Louis Stellmann, assistant engineer, succeeds Murphy. Prior to the new appointment, the latter has served successively as engineer, service manager and chief engineer, while Stellmann has served in the capacity of experimental engineer and assistant engineer. Both joined the Franklin organization in 1909, and have been with the company during their entire business careers.

W. W. Mountain, whose agreement to head the Curtiss Aeroplane & Motor Corp., Buffalo, N. Y., was given with the understanding that it be temporary, has relinquished the duties of that post to devote his entire time to the affairs of he Mountain Varnish & Color Works, which he founded about a year ago at Toledo. He will continue to make his home in Flint, Mich., running over to Toledo for four days each week to guide the company's development through close and direct contact with it.

F. E. Blanchard has been made assistant engineer of the engine division of the Buda Co., Harvey, Ill. Blanchard was formerly connected with the Milburn Wagon Co. as engineer and general manager of the truck division. His experience dates back to the early days of the Pope-Toledo Motor Car Co. and later in the testing department of the Willys-Overland Co. During the war he was active in the experimental airplane division of the Fisher Body Co.

H. G. McComb, who was made general manager of the Russell Axle plant of the McCord Manufacturing Co., Detroit, early in March, has resigned that post to return to New York City and devote his attention to interests which he had developed before going to Detroit. McComb plans to resume his former office at 1790 Broadway, which he had made the headquarters of his sales and engineering development work.

Prof. H. S. Henderson of the New York State College of Forestry at Syracuse has been engaged by the H. H. Franklin Mfg. Co., Syracuse, N. Y., to do special work in the dry kiln department, saw mill and storage yards. Prof. Henderson has closed arrangements to spend the summer with the Franklin company and has gone to Cleveland and Detroit to get information on wood untilization problems for the company.

Charles H. Johns, after twelve years of service, has resigned as president and general manager of the Wisconsin Motors Co., Milwaukee. Johns' future plans have not as yet been disclosed. He is succeeded by H. W. Schnitzky, one of the directors, who now is president and general manager. While no other changes are contemplated at present, the Wisconsin company expects to enlarge its field of activity.

Charles H. Tavener has severed his connection with the Curtiss Engineering Corporation, Garden City, N. Y., and has engaged in the practice of consulting aeronautical, industrial and production engineering with laboratory facilities at New York City and Boston. During the war he was successively a mathematical designer, production engineer and assistant plant engineer with the Curtiss corporation.

E. W McCullough, for nine years executive secretary of the Nat. Impl. & Vehicle Ass., with headquarters at Chicago has been named manager of the new Industrial Production Department of the U. S. Chamber of Commerce. In the departmentalization plan of the National Chamber this department occupies an important place because of the scope of the terms embraced in its name.

George E. Long, senior vice president of the Joseph Dixon Crucible Co., Jersey City, N. J., has resigned from that office, but will continue as a member of the board of directors. Long has been connected with the Dixon company for 43 years, beginning in the capacity of a stenographer and advancing to the offices of secretary, treasurer and vice president, respectively.

Charles C. Craig, general sales manager of the Stewart Motor Corp., Buffalo, N. Y., has been advanced to be assistant to the president and will look after the outside interests of the management. Craig is succeeded by Edward K. Roberts, who has been with the Bush Mfg. Co. for several years, and previous to that was with the Locomobile Co. of America.

A. Y. Dodge, formerly associated with the Wallis Tractor Co., has joined the Racine Engineering Co., Racine, Wis., in the capacity of chief engineer. The latter is a firm of consulting engineers recently organized by Dodge and his associates. Dodge has been connected with the Wright-Martin Aircraft Corp., and later with the Altitude & Dynamometer Laboratory, United States Department of Commerce.

OBITUARY

John Wesley Hyatt, inventor of the Hyatt roller bearing, died suddenly May 10 of heart disease in his 83rd year at his residence, Windermere Terrace, Short Hills, N. J. He was born at Starkey, N. Y., and received merely a common school education followed by one year at Eddytown Seminary. Moving to Illinois as a youth he gave all his time to inventing.

Next to the roller bearing device the most widely known of his inventions is the material called celluloid. His brother, the late I. Smith Hyatt shared in the discovery of the process of its manufacture. The following list of other patents shows the extraordinary range of his inventive talent: knife sharpener, new method of making dominoes and checkers, the Hyatt billiard ball (including the machinery for making it), water purifying system, lockstitch sewing machine, machine for squeezing juice from sugar cane, new method of solidifying hard woods for use in bowling balls, golf stick heads and mallets.

Herman J. Hass, vice president and general manager of the Peru Auto Parts Mfg. Co., Peru, Ind., died in that city on Feb. 12, following a week's illness with pneumonia, aged 57 years. He was born at Cincinnati, Dec. 23, 1862, but in 1870 his parents removed their home to Mishawaka, Ind., and it was there that he received his education and served his early apprenticeship in the plant of the Perkins Windmill Co., Toledo, Ohio, and in 1895 was advanced to the superintendency of the Canadian plant of this firm at Toronto, Ont. From 1901 to 1907 he was connected with the E. R. Thomas Motor Co., Buffalo, and following this was chief engineer of the Standard Gas & Electric Power Co., Philadelphia, until November, 1909. He then removed to Peru, Ind., becoming general manager of the Peru Auto Parts Mfg. Co. and continuing his connection with this company until his sudden demise.

Oscar B. Bannister, president Muncie Wheel Co., Muncie, Ind., died suddenly on May 12, aged 64. Born in Barnesville, O., Jan. 9, 1856, Mr. Bannister started his career as a telegraph operator on the Baltimore & Ohio Railroad. At the age of 21 he became connected with the Sandusky Wheel Works, later he was made secretary and general manager of the concern, and in 1889 he became manager of the American Wheel Works, at Jackson, Mich. Afterward he organized the National Wheel Company there and came to Muncie in 1893. Becoming associated with the Muncie Wheel Works he soon gained control of the plant in which, at the time of his death, he was associated with Harry Bannister, his son.

Alfred C. Royce, engineer of tests for the Ordance Department at the Standard Steel Works Co., Burnham, Pa., died Feb. 6, 1920, aged 29 years. He was born Aug. 26, 1890, at North Tonawanda, N. Y., and following his preliminary education attended the University of Buffalo, specializing in chemistry. His subsequent connections with the Lackawanna Steel and the Donner Steel companies at Buffalo equipped him with a practical knowledge of steel manufacture and methods of testing which was further applied for a short period preceding his entrance into the army with the Pierce-Arrow Motor Car Co. of Buffalo as an inspector of steel castings.

Theodore C. Fedders, one of the early figures in the automobile parts making field passed away May 2, at his home in Buffalo, N. Y. Fedders established, 20 years ago, the business which has come to be well known as a source of radiator supply, under the style of the Fedders Sheet Metal Works. As the Fedders Manufacturing Co. it was established in 1897, and kept under the direct supervision of its founder up until about six years ago, when he gradually relinquished active interets in the management to his four sons, Louis F., John M., Charles W., and Theodore C., Jr., all of whom survive him.

Nelson S. Pringle, engineer of tests for the Autocar Co., Ardmore, Pa., died of pneumonia, Feb. 2, 1920, aged 34 years. He was born at Newark, N. J., Nov. 19, 1885, and following his preparatory education attended Stevens Institute of Technology, Hoboken, N. J., graduating as a mechanical engineer in 1911. From 1901 to 1907 he was export business manager for the introduction of American automobiles to the Far East, his activities in this connection being mainly of an engineering nature. His connection with the Autocar Co. was immediately subsequent to his graduation in 1911.

Emil M. Lowy, technical representative of the Rhineland Machine Works Co., New York City, died Jan. 15, 1920. He was born April 2, 1884, at Hermannstadt, Hungary, and received his preliminary and technical education in Budapest and in Charlottenburg, Germany. From 1906 to 1908 he was designing engineer of locomobiles and steam shovels for the Isthmian Canal Commission, Panama, afterward being connected with several different firms in engineering and managerial capacities until 1911.

Otis E. Mansur, secretary and treasurer, Velie Motors Corp., Moline, Ill., passed away at his home there May 30. He was born in Boston, Mass., June 25, 1867, and consequently was almost 53 years old. In 1913 he married Miss Florence Kerns, who survives him.

Activities of Automotive Manufacturers

Where They Are Located What They Are Doing How They Are Prospering

Federal Motor Truck Co., Detroit, has purchased 60 acres three blocks west of Grand River on the Detroit Terminal railroad, to provide for future expansion. Construction on the new works will not begin for some time as the plans are not completed. Pending their completion, the immediate need for more manufacturing facilities will be cared for at the present plant on Federal Avenue by the erection of a new unit between the Michigan Central tracks and Federal Avenue. This will provide 60,000 to 70,000 additional sq. ft. of space. The new unit of 75,000 sq. ft. erected a year ago is not sufficient to care for the increase in business.

Paige-Detroit Motor Car Co., Detroit, is planning for the early removal of its present machine shop to the new building now being completed on the site of its proposed new works, West Warren Avenue and the Detroit Terminal Railroad. At an early date a four story building will be erected. A portion of the new machine shop will be equipped for motor and truck assembling, as well as testing. The vacated building will be utilized for increased capacity in the trimming and other departments. The company has a 50-acre tract for its new plant and the entire works will aggregate about 4,000,000 sq. ft. of manufacturing space.

American-La France Fire Engine Co., Elmira, N. Y., in connection with the operation of its new works at Bloomfield, N. J., now in course of construction, will enter the commercial truck field, and will use this plant for truck and parts manufacture. It has a tract of 23 acres and the first unit, estimated to cost about $100,000, will be supplemented by other buildings. It is expected to have the plant ready for operation during the winter.

Daniels Motor Car Co., Reading, Pa., has acquired property at Hunting Park Avenue, Westmoreland and Fox Streets, Philadelphia, averaging about 310 x 1421 ft., for the erection of a new plant estimated to cost close to $500,000. The total site aggregates about 6 acres and will be improved with a number of buildings. It is planned to move the present works from Reading to the new location as soon as the structures are ready for occupancy.

Columbia Motors Co., Detroit, has outgrown its plant at Mack and Beaufait Avenues, and it is proposed to build a new factory fronting 400 ft. on Fort Street and 700 ft. on Boyd Street. At the rear will be located the power plant, cold storage and several small buildings, including an employees' cafe and recreation room. The company plans to retain its present buildings for manufacturing and storage purposes.

Turner Mfg. Co., Port Washington, Wis., has contracted with Frank D. Chase, Inc., 645 North Michigan Avenue, Chicago to design and erect a brick and steel foundry addition, 60 x 150 ft., and a two story machine shop addition, 40 x 90 ft., ft., to increase its output of gas engines, tractors, etc. Inquiry is being made for a considerable list of miscellaneous equipment. W. A. Englehart is works manager.

Ordnance Department have prepared plans for remodeling the storage buildings at the Raritan Arsenal, Metuchen, N. J., into shop structures, to be equipped for automobile truck maintenance and repair instruction work. The constructing quartermaster, Raritan Arsenal, with office at the Temporary Motor Storage, South Amboy, N. J., is in charge.

Vim Motor Truck Co., Twenty-third and Market Streets, Philadelphia, has acquired through the War Department the former gun plant of the Midvale Steel & Ordnance Co., at Wayne Junction, for the manufacture of motor trucks. The site comprises about 25 acres. The buildings will be remodeled. E. E. Smith is president.

Doble Co., Inc., Emeryville, has been incorporated with a capital stock of $100,000 by John A., Jr., William A. and Warren Doble, George A. Sargent and E. M. Mason, all of San Francisco. It will immediately erect a plant at Emeryville, Cal., for the manufacture of engines, tractors, vehicles and water craft.

Hamilton Motors Co., Grand Haven, will double its manufacturing facilities as soon as factory units can be erected. The capital stock has been increased from $500,000 to $1,000,000. Adolf Pricken is president, Peter Van Zylon, vice president, and W. G. Jarmin secretary treasurer and general manager.

Schacht Motor Co., Evans Street, Cincinnati, mortor trucks, has increased its capitalization from $100,000 to $200,000, to take care of increasing business. While no extensions are contemplated at present its growing business may render further expansions necessary in the near future.

Franklin Tractor Co., Dayton, which is erecting a plant in Greenville, O., will increase its capitalization from $300,000 to $2,000,000, the additional capital to be used for the erection of another building at Greenville. Work will start as soon as the first structure is completed.

Commercial Truck Co. of America, Twenty-seventh and Brown Streets, Philadelphia, manufacturer of automobile trucks has awarded contract to the W. L. Steele & Sons Co., 40 North Sixteenth Street, for a new plant at Hunting Park Avenue and Rising Sun Lane.

Stevens-Duryea, Inc., Chicopee, Mass., automobiles, will erect three more buildings on its property in Willimansett, to cost approximately $40,000. Two structures will be 300 x 320 ft., of sawtooth construction, and the other, a heat treating building, will be 60 x 270 ft.

National Automobile Chamber of Commerce, admitted to membership at the last meeting the following companies. Rainier Motors Corporation, Flushing, L. I., American Motor Truck Company, Newark, Ohio, and Kentucky Wagon Manufacturing Company, Louisville, Ky.

Premier Motor Corporation of America, 801 Pennsylvania Building, Philadelphia, plans to lease or buy a local plant for the manufacture of a four-cycle, marine type engine and a two-cycle motor. Timothy O'Leary is president.

Gearless Motor Co., Pittsburgh, has awarded a contract to Peter Schmidt, 36 Mount Oliver Way, Mount Oliver, for a one story plant, 32 x 192 ft., on Flavel Street, East Liberty, for automobile assembling work. George O. Rogers, Hartje Building, is the architect.

Union Motor Car Corporation, Eaton, O., has been incorporated under the laws of the State of Delaware for $1,000,000, and the erection of a plant is contemplated to build motor cars. A. H. Christman, Eaton, is president.

H. H. Franklin Mfg. Co., 302 South Geddes Street, Syracuse, N. Y., manufacturer of automobiles, is arranging for an increase in its capital stock from $7,000,000 to $40,000,000 to provide for proposed expansion.

Robinson Motor Truck Co., 909 Hennepin Avenue, Minneapolis, Minn., is completing plans for a two story service and repair works, 65 x 110 ft., at Seventeenth Street and Nicollet Avenue, to cost about $100,000.

White Automobile Co., East Seventy-ninth Street, Cleveland, has awarded a contract to A. B. Gade, Atlanta, Ga., for a two story service and repair building, 180 x 240 ft., at Atlanta, to cost about $200,000.

Erie Motor Truck Co., Commerce Building, Erie, Pa., has awarded a contract to S. M. Stade, Palace Hardware Building, for a one story plant in the Wesleyville section, 60 x 350 ft., to cost about $125,000.

Oshkosh Motor Truck Co., Oshkosh, Wis., has broken ground for the first unit of its new factory on a new site. It will be 102 x 410 ft., of brick and steel. Auler & Jensen, Oshkosh, are the architects.

Burn Oil Tractor Co., Warren, Ind., will soon commence the construction of a tractor plant, 40 x 210 ft., on the north side of the Toledo, St. Louis & Western Railroad and the Warren fair grounds.

Dodge Brothers, Joseph Campau Avenue, Detroit, manufacturer of automobiles, will commence the immediate erection of a new eight story brick and steel plant, 75 x 266 ft.

C. L. Best Gas Traction Co., San Francisco, whose plant is located at San Leandro, is offering $1,250,000 preferred stock and proposes to double the size of its plant.

Gem Auto Truck Co., Troy, N. Y., which is manufacturing a light four-cylinder truck, will expand its facilities. A few new tools have been purchased.

Bethlehem Motors Corporation, Allentown, Pa., motor trucks, is considering expansion for the development of passenger automobiles.

All-in-One Tractor Co., Oakland, manufacturer of farm tractors, is contemplating the erection of a new plant at Woodland, Cal.

Ford Motor Co. of Canada, Ltd., 680 Waterloo Street, London, Ont., will erect an addition to cost $100,000.

Haynes Automobile Co., Kokomo, Ind., has increased its capital stock from $2,500,000 to $4,000,000.

Service Motor Truck Co., Wabash, Ind., has increased its capital stock from $2,000,000 to $3,000,000.

Automotive Tractor Corporation, Frederick, Md., will enlarge its plant.

Parts Makers

Aluminum Manufacturers, Inc., Cleveland, formerly the Aluminum Castings Co., has sold its Carnegie Avenue plant to the Oster Mfg. Co., and has moved its general offices to its Harvard Avenue works. It will give up possession of the brass foundry May 15, and will continue to operate its Carnegie Avenue aluminum foundry until Nov. 15. Among the recent changes in the organization is the election of George J. Stanley, formerly with the Aluminum Co. of America, as vice president and treasurer. No production manager has been chosen to succeed Paul Ryan, who recently resigned to become manager of the Perfection Spring Works of the Standard Parts Co., but F. A. Parkhurst, who was associated with the company several years ago, has become affiliated with it, devoting a portion of his time as organization engineer and assumes some of the duties that were formerly under the direction of Mr. Ryan.

Westinghouse Union Battery Co., Pittsburgh, recently organized by the Westinghouse interests, will manufacture storage batteries for all branches of industry. It is now occupying a portion of the works of the Union Switch & Signal Co., Swissvale, and is giving employment to about 500. Tentative plans include a new plant on a neighboring site to provide a daily capacity of over 3000 batteries. A. L. Humphrey, president Westinghouse Air Brake Co., is chairman of the board of directors; T. R. Cook, formerly chief engineer and production manager for the Willard Storage Battery Co., Cleveland, is vice president and general manager.

Vulcan Motor Axle Co., Detroit, has been organized by a group of men who have been prominent in axle work, including F. C. Gilbert, for many years with the Timken organization and vice president when he resigned, R. G. Beechler, formerly works manager of the Timken metal products plant, R. B. Weaver, Sidney C. Love, C. C. Miller and J. T. Hanlon. Mr. Gilbert is president and treasurer, Mr. Hanlon secretary, and Mr. Beechler, chief engineer. The plant is at Milwaukee Junction, and machinery is being installed.

Racine Engineering Co., Racine, Wis., has been organized to engage in general automotive engineering in relation to the farm machinery and tractor industries. Offices have been opened at 105 Badger Building. The principals are L. N. Burns, formerly vice president and sales manager J. I. Case Plow Works Co.; A. Y. Dodge, who will be chief engineer, and H. L. Taite, a mechanical engineer also formerly with the Case company.

Doehler Die Casting Co., Court and Ninth Streets, Brooklyn, manufacturer of die castings, brass and bronze alloy castings, etc., has arranged for a bond issue of $1,000,000. It is now operating two plants in addition to its Brooklyn works, at Toledo, Ohio, and Chicago, with total floor area aggregating 350,000 sq. ft. Employment is given to 2300. H. H. Doehler is president.

Stewart-Warner Speedometer Corporation, Chicago, has effected arrangements for the absorption of the Stewart Mfg. Corporation, manufacturer of dies, die castings, etc., 4535 Fullerton Avenue, Chicago. This will be done through an exchange of stock. The companies have been affiliated in ownership, both having been organized by the late John K. Stewart.

Evinrude Motor Co., 279 Walker Street, Milwaukee, which has broken ground for the first unit, containing 60,000 sq. ft., of a new manufacturing group at Twenty-seventh and Lake streets, expects to transfer its operation about Nov. 1. Its present four-story factory, 100 x 140 ft., has been sold to the Western Wosrted Mills, 3033 Galena street.

Wico Electric Co., Springfield, has incorporated under Massachusetts law to manufacture magnetos, storage batteries, ignition equipment and specialties in its West Springfield plant. It is capitalized at $400,000. Phelps Brown, 44 Avon Place, is president; Arthur W. Lamson, vice-president and Edward L. Stoughton, treasurer.

Continental Motors Corp., Detroit and Muskegon, Mich., has just purchased a tract of 400 acres at Muskegon, along the Muskegon River. A big foundry will be erected, and other buildings, for which the company seeks to harness the river to provide power. Some two thousand homes for employeers will be built on this new tract.

A. B. Landis & Sons have moved into their recently acquired plant at Cresheim Road and Queen Street, Chestnut Hill, Philadelphia, where they will grind both crank and cam shafts and manufacture automobile parts complete. The building occupies 5000 sq. ft. and provides an increase in former capacity of about 300 per cent.

Sears-Cross Co., Brooklyn, N. Y., manufacturer of the Sears-Cross lock for automobile doors, has been acquired by the National Seal Co., Brooklyn, N. Y., maker of metal seals and automobile hardware. The personnel of the former company will continue with the new organization, and plans are under way for additional facilities.

American Axle Co., Chicago, manufacturer of worm-drive rear axles for motor vehicles, has awarded the general contract to the Austin Co., Chicago, for a brick and steel machine shop, 100 x 600 ft., at Barton, Washington County, Wis. It will cost about $100,000, including equipment. Peter C. Wolf Barton is in charge.

The new plant of the Prest-O-Lite Co., Indianapolis, Ind., manufacturer of acetylene apparatus, at Orangeville, Baltimore, is estimated to cost about $100,000, according to plans now prepared. The works will comprise a number of reinforced-concrete buildings. Employment will be given to over 200 for initial operations.

Evinrude Motor Co., 279-281 Walker Street, Milwaukee, has given the entire contract for designing, erecting and equipping its new works at Twenty-seventh and Lake Streets to the Federal Engineering Co., 444 Milwaukee Street, Milwaukee. The project involves an investment of $50,000.

Lavine Gear Co., Keefe Avenue, Milwaukee, has placed the general contract with Frank Luenzmann Co., 1912 Prairie Street, for a one-story machine shop addition, 50 x 153 ft. It manufactures steering gears and other automotive parts. Herman A. Uihlein, 521 Grand Avenue, is president.

Sheldon Axle & Spring Co., Conyngham Avenue, Scranton, Pa., manufacturer of automobile axles and springs, is planning for a two-story addition, 50 x 80 ft. to cost about $125,000, including equipment. The company is a subsidiary of the Spicer Mfg. Co., South Plainfield, N. J.

Jones Oil Engine Co., Syracuse, N. Y., has purchased one of the Government war buildings at Ilion, N. Y., and will dismatle it and move it to Syracuse, where it will be reconstructed and utilized for the manufacture of oil engines. New equipment probably will be required.

Hess-Bright Mfg. Co., Front and Erie Streets, Philadelphia, manufacturer of ball bearings, etc., has increased its capital stock from $2,000,000 to $3,000,000. The company has completed plans for the erection of three one story additions, 32 x 295 ft., 24 x 350 ft., and 32 x 120 ft.

Lauchin-Loehr Piston Co., Green Bay, Wis., has increased its capital stock from $25,000 to $50,000 and will enlarge its floor space and equipment to double the output of self-lubricating pistons for high speed gas engines. George Y. Lauchin is president and chief engineer.

Henry M. Dudle La Pierre Co., manufacturer of automobile steering wheels, 1314 West Twenty-first Street, Chicago, will receive bids through an architect on a two story plant, 50 x 145 ft., Circle Avenue and Fourteenth Street, Forest Paark, Ill., to cost $50,000.

United States Axle Co., Pottstown, Pa., has been organized to manufacture automobile axles and will take over the plant of the Industrial Foundry & Machine Co., Laurel and Washington Streets' heretofore used for the manufacture of steam specialties, etc.

Diefendorf Gear Corporation, Syracuse, N. Y., is a new concern, of which Willis Diefendorf, formerly with the Weekes-Hoffman Co., is president. Temporary manufacturing space has been obtained on the top floor of the Weekes-Hoffman building.

Eclipse Mfg. Co., Hammond, Ind., recently organized for the manufacture of gears, automobile parts, patent awning supporters, etc., has completed arrangements for a four story plant, 76 x 129 ft., to cost $50,000, at Conkey Avenue and Blaine Street.

A. C. Spark Plug Co., a subsidiary of the General Motors Corporation, will establish a manufacturing plant at Brantford, Ont., where a site of 16 acres has been purchased. Construction will start at once and it is expected to be completed in 60 days.

International Steel Products Co., Hartford, Wis., which has devoted its attention to making mufflers or silencers for gas engines, is putting into quantity production a new type of pressed steel fuel tank for motor vehicles.

J. T. Fleck, Chico, Cal., has leased a building on Park avenue and contemplates the immediate establishment of a plant for the manufacture of automobile bodies, radiators and other sheet metal products.

Simms Magneto Co., North Arlington Avenue, East Orange, N. J., manufacturer of magnetos and ignition systems, has filed plans for a two story, reinforced-concrete addition to cost about $250,000.

Kearns-Dughie Motors Corporation, Beavertown, Pa., has been incorporated with a capital stock of $100,000 to manufacture automobile motors, parts, etc. M. V. Dughie, Lewistown, is treasurer.

Deering Mfg. Co., Brainerd, Minn., has been started with $25,000 capital to build motor vehicle parts and accessories. Julius H., Alma Gail, and Caroline A. Deering are the incorporators.

Amesbury Mfg. Co., St. Petersburg, Fla., has been incorporated with a capital stock of $20,000 by C. H. Prescott, B. S. Wright and E. B. Holcomb, to manufacture automobile truck bodies.

Brewer-Titchener Corporation, Binghamton, N. Y., manufacturer of automobile hardware, etc., has completed plans for a one and two-story addition, 144 x 200 ft., to cost about $100,000.

Crosby Co., 137 Pratt Street, Buffalo, manufacturer of sheet metal stampings, has had plans prepared for a one story brick and steel addition, 100 x 125 ft., to cost about $50,000.

Keystone Automobile Top Co., 1412 Fairmount Street, Philadelphia, is taking bids for a four-story plant, 80 x 140 ft., at Fairmount and Seventeenth streets.

Mulholland Co., 208 Washington avenue, Dunkirk, N. Y., manufacturer of automobile bodies and parts, has increased its capital stock from $50,000 to $150,000.

A. J. Detlaff Co., 121 Lafayette Avenue, Detroit, manufacturer of iron castings, etc., is planning for the erection of a one story foundry addition, 51 x 85 ft.

American Bearing & Die Casting Corporation, Indianapolis, Ind., has issued $250,000 of preferred stock, making the total capitalization $750,000.

Automobile Crank Shaft Corporation, 192 Piquette Avenue, Detroit, will build a one story plant, 40 x 165 ft., at an estimated cost of $25,000.

Motor Parts Corporation, Pittsburgh, a Delaware corporation, has increased its capital stock from $450,000 to $650,000.

Climber Corp., Little Rock, Ark., has broken ground for a body building plant.

Body Builders

Phineas Jones & Co., 305 Market Street Newark, manufacturer of automobile wheels, bodies, etc., has acquired about 15 acres at Millside for a new plant. The works will consist of a number of buildings, with a unit 40 x 300 ft., for assembling and general production; other structures will be 120 x 124 ft., with L-extension, 55 x 50 ft.; band shop, 50 x 120 ft.; power plant, 30 x 60 ft.; and a series of 24 kilns, each 19 x 27 ft. The plant is estimated to cost about $300,000 to $500,000. William E. Lehman, 738 Broad Street, is architect.

Commercial Body Co., Columbus, O., has taken over the business of the Warren & Southwick Carriage Co., of that city. The new company is under the active management of C. W. Finch, A. M. Lupton and C. R. Benner, and will manufacture bodies for all kinds of motor trucks. It intends to carry a large stock of bodies for several styles of trucks, but will give special attention to bodies for Ford one-ton trucks.

Buffalo Body Corporation, Buffalo, N. Y. manufacturers of fine automobile bodies, has completed installation of additional equipment and is actively engaged on a large special order of enclosed bodies for the Packard Motor Car Company. They will employ several hundred additional skilled enclosed body builders at their plant at Buffalo.

Dayton Body & Cabinet Co., Dayton, O., has been incorporated at $50,000 to manufacture commercial bodies for trucks and automobiles. Among the men behind the new enterprise are C. C. Breech, D. L. Waggoner, D. L. King, J. Davies and V. B. Duvall. The new concern, with several locations in view, hopes to be in operation by the first of next month.

Flint Varnish & Color Works, Flint, Mich., has expanded so rapidly in automobile and general industrial varnishes and paints that additional plant facilities have become necessary. Accordingly the E. I. du Pont de Nemours & Co., together with the Flint concern, have purchesed the plant and business of the Chicago Varnish Co., Chicago.

Field Body Corporation has been incorporated to take over the Field Mfg. Co., Owosso, Mich., owned by J. E. Field, who will be president of the new company. Capacity will be tripled to produce the all-year-round cab and the interchangeable platform bodies upon which the concern specializes.

Collins Plow Co., Quincy, Ill., has purchased the entire business of the Miller Wagon Co., Edina, Mo., The merchandise department of the Collins Plow Co. has been handling the Miller wagon for a number of years.

Landis Body Building Co., Lansdale, Pa., has been sold to the Heebner-Felver Motor Co., which will operate it in connection with its automobile business. Mr. Landis remains as manager of the body building plant.

McDermott Body Corporation, 123 Sixth Street, Long Island City, manufacturer of automobile bodies, has acquired about 20,000 sq. ft. at Van Alst Avenue and Thirteenth Street for a new two story plant.

Perfect Body Corporation, a subsidiary of the Sanger Motor Car Co., has leased the one story building at Madison Avenue, 136th to 137th Streets, Bronx, covering an area of 40,000 sq. ft.

Willoughby Co., Dwyer Avenue and Turner Street, Utica, N. Y., manufacturer of automobile bodies, is having plans prepared for a four story addition, 75 x 150 ft., to cost about $50,000.

Belmont Body Builders Corporation, Belmont Avenue, Newark, manufacturer of automobile bodies, has completed plans for a one story plant to cost about $16,000.

Fisher Body Co., Oakland Street, Detroit, manufacturer of au-

tomobile bodies, is having plans drawn for a new six story plant, [illegible] x 970 ft., on West End Avenue.

West Penn Body Co., Wilkinsburg, Pa., has been incorporated with a capital stock of $50,000 to manufacture automobile bodies. [illegible]. Mutchler is treasurer.

Brooks-Ostruk Co., 225 West Sixty-sixth Street, New York, manufacturer of automobile bodies, has increased its capital stock from $150,000 to $1,000,000.

Field Mfg. Co., Owosso, Mich., manufacturer of motor truck bodies, will sell $200,000 worth of stock to finance its expansion program.

Stahli Auto Body Company, Cleveland, has been incorporated with [illegible],000; E. E. Stahli, R. Stahli, R. Fisher, E. W. Fisher and W. F. Kees.

Eastern Auto Body Co., Bridgeport, Conn., is figuring on a one and a half story, 60 x 90 ft. plant.

Auto Body Co., Portsmouth, N. H., is having plans drawn for an addition to the plant.

Sodium Fluoride as a Wood Preservative

Tests made years ago at the Forest Products Laboratory indicated that sodium fluoride might be successfully used as a wood preservative, because it had high toxicity, was not injurious to metal, and was convenient to handle. Laboratory tests alone, however, are never sufficient to establish the value of any material as a wood preservative; actual service tests, even though they require years to complete, are also needed.

In order to obtain comparative durability records, the laboratory in 1914 placed sap-pine ties treated with sodium fluoride, together with ties treated with zinc chloride and creosote, in one of the mines of the Tennessee Coal, Iron and Railway Company, at Birmingham, Alabama. Similar service tests were also started at this time on red oak ties placed in the tracks of the Baltimore and Ohio Railway Company.

After five years of service the mine ties which were treated with sodium fluoride have been found in as good condition as those treated with zinc chloride, both showing very little deterioration. The creosoted mine ties apparently were in still better condition, while the untreated ones were in various advanced stages of decay. The red oak railway ties treated with sodium fluoride were practically all sound, as were those treated with zinc chloride, whereas a large percentage of the untreated oak ties had been removed.

Both of these tests, as well as others started later, must continue for a number of years yet before the relative value of the sodium-fluoride treatment for ties and timbers is definitely known.

In February, Major R. W. Schroeder, chief test pilot at McCook Field, Dayton, O., reached an altitude of 36,020 ft., about 5,000 ft. higher than the previous world's record height.

WANTS

Wanted:—West Tire Setter No. 3, in good condition. A. E. Stevens & Co., Portland, Me.

For Sale:—Wheelwright and auto repair business, established over 25 years. Very conveniently located. Obliged to sell because of death of former owner. For particulars, address G. H. Blume, Railroad Ave., New Rochelle, N. Y.

PATENTS

Patents—H. W. T. Jenner, patent attorney and mechanical expert, 622 F St., Washington, D. C. Established 1883. I make an examination and report if a patent can be had and exactly what it will cost. Send for circular.

Index To Advertisers

The Automotive Manufacturer

The Hub of Automotive Engineering

BODY BUILDING - AUTOMOTIVE PARTS - ALLIED INDUSTRIES

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The Automotive Manufacturer

The Hub ← A CONSOLIDATION OF → AUTOMOTIVE ENGINEERING

Vol. LXII NEW YORK, JULY, 1920 No. 4

Greater Possibilities in Automatic Electric Welding Machines

By H. L. UNLAND*

New Device Makes Welding More Than a Repair or Patching Process and Opens Up Chances for This Process to Qualify as Important Manufacturing Auxiliary

THROUGH the medium of a new automatic welding outfit developed by the General Electric Co., Schnectady, N. Y., and now being placed upon the market by that company, the modern manufacturing plant quick to take up new and better things, is offered a new tool. With the perfection of this device, upon which the company's engineers have been working for several years, an entirely new field of work is opened up which may represent a saving of material or of work (that is, labor), or of money or perhaps all three—namely, manufacturing by means of the electric arc using this new machine which is fully automatic in its action, when once set and started. This automatic machine, which is called the automatic arc welder, and some of its work are shown and described on the following pages.

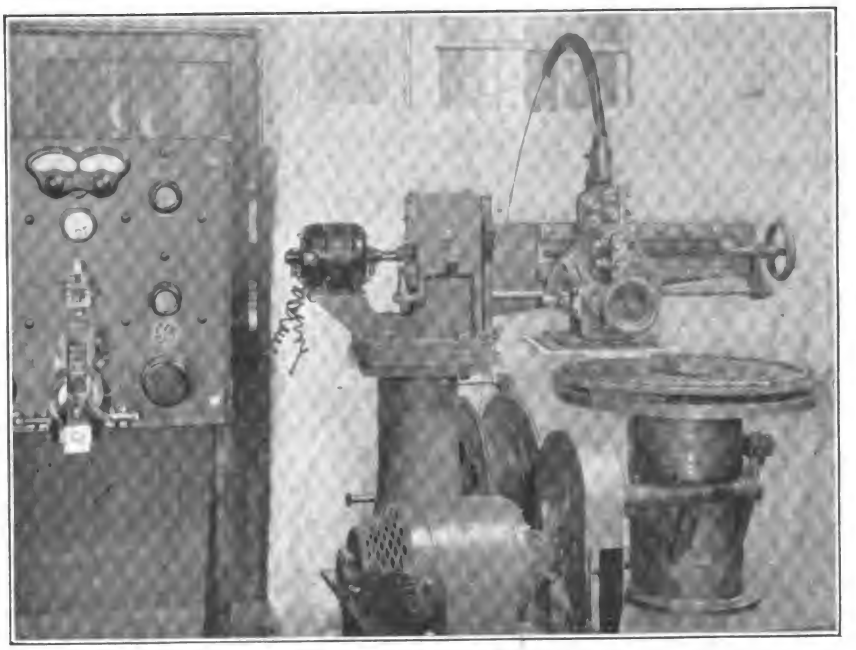


Fig. 1—Automatic Arc Welding Head and Control Panel. The welding head proper is movable along arm by means of hand wheel to provide means for following variations in weld. The head may be tilted approximately 45 deg. at right angles to and parallel to line of weld. Welding head is shown supported on pedestal with work clamped to small turn table which is revolved at proper speed by small motor. Two sets of straightening rolls are provided for straightening electrode wire as it passes from wire guide to feed roll

The automatic arc welder is a device for automatically feeding the metallic electrode wire into the welding arc at the rate required to hold a constant arc length. Under these conditions the electrical conditions are kept constant and the resulting weld is uniform and its quality is thereby improved. It is possible with this device to weld at a speed of from two to six times the rate possible by skilled operators welding by hand. This is partly due to the stability of the welding conditions and partly due to the fact that the electrode is fed from a continuous reel, thus eliminating the changing of electrodes. The automatic welder is adaptable to practically any form of weld from butt welding of plates to the depositing of metal on worn surfaces such as shafts, wheels, etc.

Everyone who has made any investigation of electric arc welding has noted the wide variation in results obtained by different welders operating, as nearly as can be determined, under identical conditions. This also applies to the operations of a single welder at different times under identical conditions. These variations affect prac-

*Engineer, Power and Mining Department, General Electric Co. Taken in part from a paper read before the American Welding Society.

tically all factors of welding such as speed of welding, amount of electrode consumed, etc. When indicating instruments are connected to an electric welding circuit, continual variations of considerable magnitude in the current and voltage of the arc are at once noticed. This same condition was found some years ago in the cutting of steel plates by the gas process and when an equipment was devised to mechanically travel the cutting torch over the plate a series of tests to determine the maximum economical speed, gas pressure, etc., for the various thickness of plate were made. The result was that the speed of cutting was increased to as much as four or five times the rate possible when operating under the unsteady conditions incident to hand manipulation of the torch. Further, the gas consumption for a given cut was found to be decreased very greatly.

Fig. 2—Automobile wire wheel hub. Joint between 1/16 and 3/16 in. sheet metal. Current 100 amperes, arc voltage 14, travel 10 in. per minute, electrode diameter 3/32 in.

As a result of these experiences an investigation was started to determine what could be done in controlling the feed of the electrode to the electric arc in a metallic electrode welding circuit. An electric arc is inherently unstable, the fluctuations taking place with extreme rapidity. In any regulating devices the sensitiveness depends on the percentage of variation from normal rather than

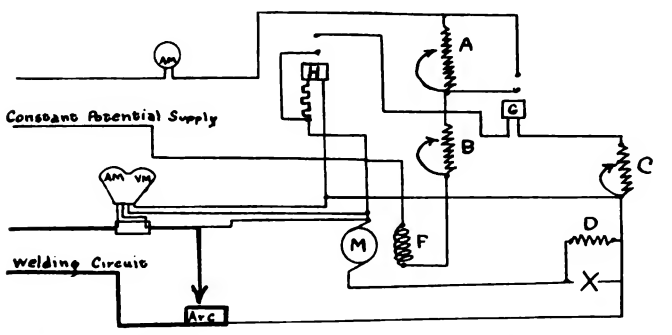


Fig. 3—Simplified connection diagram of automatic arc welding control. Motor armature M is connected across arc and protected from open circuit voltage by resistor D which is short circuited when arc is struck by contractor X. Motor field FF is excited from constant potential supply, variation in field current being obtained by contacts of regulator G short circuiting variable portion of regulating rheostat A. Regulator G is connected across arc through regulating rheostat C and contacts of over voltage relay H, which protects regulating relay coil from high open circuit voltage and only closes these contacts when arc is struck

on the actual magnitude of the values, since these are always reduced to approximately a common factor by the use of shunts, current transformers, or series resistances. The characteristics of practically all electric welding circuits are such that the current and voltage are inter-related, as increase in one causing a corresponding decrease in the other. Where this is the case it will generally be found that the percentage variation of the voltage from normal when taken at the customary arc voltage of 20, will be approximately twice the percentage variation in current. Further, an increase in arc voltage, other conditions remaining the same, indicates that the arc has been lengthened, thus giving the metal a greater opportunity to oxidize in the arc, with a probability of reduction in quality of the weld. The automatic welder utilizes the arc voltage as the basis for regulating the equipment. The rate of feeding the wire varies over a wide range due to the use of electrodes of different diameters, the use of different current values, etc., caused by details of the particular weld to be made. The simplest and most reliable method of electrically obtaining variations in speed is by means of a separately excited direct current motor. Thus the operation of this equipment is limited to direct current arc welding cirucits but these may be of any established type, the variations in characteristics of the welding circuits being taken care of by proper selection of resistors, coils etc., in the control.

The welding head consists essentially of a set of rollers for gripping the wire and feeding it to the arc. These

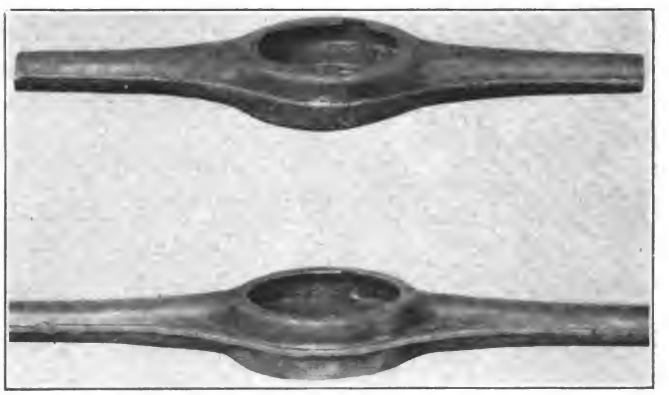


Fig. 4—Automobile rear axle housing. Metal 3/16 in. thick, current 120 amperes, voltage 14, travel 6 in. per minute, electrode diameter 3/32 in.

rollers are suitably connected through gearing to a small direct current motor, the armature of which is connected across the terminals of the welding arc. This connection causes the motor to increase in speed as the voltage across the arc increases due to an increase in the length of the arc and to decrease in speed as the voltage decreases due to a shortened arc. A small relay operating on the principle of a generator voltage regulator is connected in the field circuit of the motor which assists in the speed control of the motor as the arc voltage varies. Rheostats for regulating and adjusting the arc voltage are provided by means of which the equipment can be made to maintain steadily an arc of the desired length and this value may be varied from over twenty to as low as nine volts. No provision is made for adjustment of the welding current since the operation of the automatic machine is in no way dependent on it. This adjustment is taken care of by the central panel of the welding set. This may be either of the variable voltage or constant potential type but it is necessary to have a source of constant potential to excite the fields of feed motor. It may be possible to obtain this

excitation from the welding circuit but this is not essential. The voltage of both the welding and constant potential circuits is immaterial provided it is not too high, but these voltages must be known before the proper rheostats can be supplied.

Observation of indicating meters on the control panel show that the current and voltage are practically constant, but it should be remembered that all indicating meters have a cerain amount of damping which prevents the observations of variations which are extremely rapid or of small magnitude. The resultant value as read on the instrument is the average value. Oscillographs taken with short arcs show that notwithstanding the fact that the indicating meters show a constant value, a succession of rapid short circuits is continually taking place, apparently due to particles of the molten wire practically short circuiting the arc in passing from the electrode to the work. This is indicated by the fact that the voltage curve fell to zero each time accompanying each such fluctuation, there was an increase in the current. It was found that with the shorter arc the frequency of occurrence of these short circuits was considerably higher than was the case when the arc was increased in length. To all appearances the arc was absolutely steady and continuous and there was no indication either by observation of the arc itself or of the instruments that these phenomena were occuring.

The following tables give an idea of the speed of welding which may be expected but it should be borne in mind that these figures are actual welding speeds. It is necessary to have the material properly clamped and supported and to have it travel past the arc at a uniform speed. In some cases the figures given here have been exceeded and under certain special conditions it may be desirable to use lower values than those given.

Seam Welding

Thichkness in inches	Amperes	Speed inches per minute
.040	45 to 50	20 to 30
1/16	50 to 80	15 to 25
1/8	80 to 120	15 to 25
3/16	100 to 150	4 to 6

Building Up (Wheel or Shafts)

Dia. or thickness inches	Electrodes dia. ins.	Amperes	Speed ins.	Lb. deposit
Up to 1 in.	1/16	60 to 90	11 to 13	1.04-1.56
Up to 3 in.	3/32	90 to 120	6 to 8	1.59-2.1
Over 3 in.	1/8	120 to 200	4 to 6	2.5 -4.5

On account of the great variation in conditions under which this equipment may be used it is provided with a base which may be bolted to any form of support. It may be held stationary and the work traveled past the arc or the welding head may be movable and the work held stationary. These points will be dictated by the relative size of the work and the head and the equipment which may be available. Provision must be made for traveling one or the other at a uniform speed in order to carry the arc along the weld. In the case of straight seams a lathe or planer bed may be utilized for this purpose and for circular seams a lathe ro boring mill may be used. In many

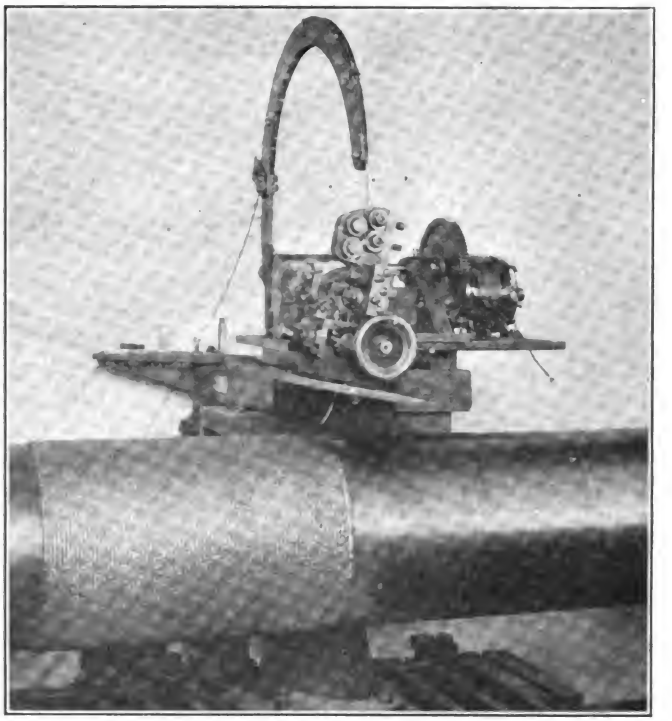


Fig. 5—Reclaiming large shaft on which flywheel set was machined under size. This shaft was 14 in. in diameter and set was about 21 in. long. About 3/16 in. of metal was deposited on this seat in one layer and in one continuous operation. Welding figures are as follows: Current 190 amperes, arc voltage 18, electrode 1/8 in. diameter, travel 4 in. per min., rate of deposition about 2 lb. per hour. Time required—welding 16 hours, machining 4 hours

be held stationary and the work traveled past the arc or the welding head may be movable and the work held stationary. These points will be dictated by the relative size of the work and the head and the equipment which may be available. Provision must be made for traveling one or the other at a unform speed in order to carry the arc along the weld. In the case of straight seams a lathe or planer bed may be utilized for this purpose and for circular seams a lathe or boring mill may be used. In many cases it will be found desirable to use clamping jigs for securely holding the work in shape and also to facilitate placing in position and removal from the feeding mechanism.

Referring to Fig. 5, the shaft was rotating while the work was being done and at the same time the cross heat was being traveled along the shaft. The result was a con-

(Concluded on Page 35)

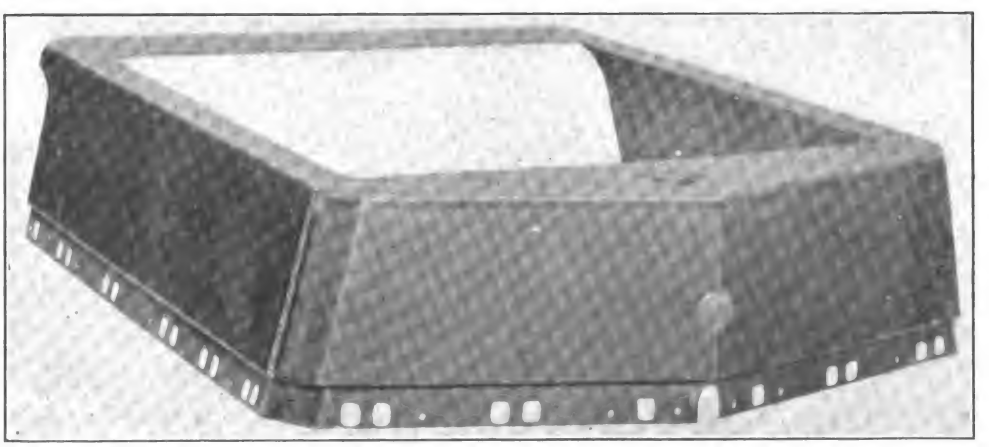


Fig. 6—Worn Journal of Motor shaft built up. Regularity and uniformity of deposited metal can be plainly seen.

From Ore to Finished Auto in Ford's River Rouge Plant

By F. L. PRESTISS*

Another Step in Ford's Broad Plans to Reduce Cost of Motor Cars, Consisting of Addition of Blast Furnace to Car Plant and Pouring Direct

WHEN anyone proposes to reduce the time, labor and cost of manufacturing automobiles, whether he be great or small, world-famous or unknown, if his scheme is sound everyone in the industry will wish him good luck. Stating the case that way, it sounds like the off-hand endorsement of a wild scheme. But when it is stated that the method described is the idea of Henry Ford, and that it has all the resources, physical, financial and of brainy men of the Ford organization back of it, the situation is altered. When it is stated further that the plan is not just an idea or a scheme, but is now in actual operation and that the pictures and drawings herewith are actual reproductions of real apparatus now in daily use, it ceases even to be just an idea, a scheme, and becomes a reality. As such it is well worth the most thorough study.

Ford's idea in this case was to incorporate the blast furnace and iron ore pile in the automobile plant, not simply as a pig iron producer added to the plant so as to save haulage, but incorporated in the design of the plant

*By special editorial arrangement with Iron Age, New York.

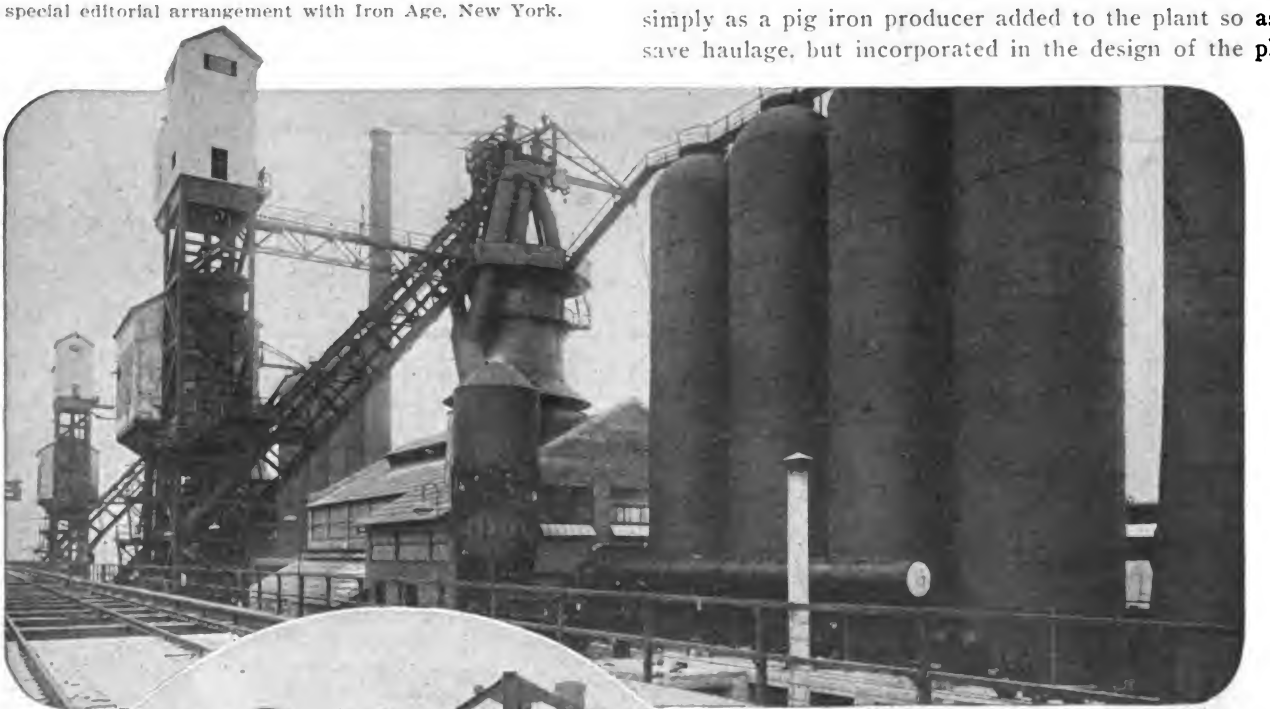


Fig. 1—General view of Ford furnaces. Gas from each furnace is carried through four uptakes extending 25 feet above the platform. Two of these uptakes as shown in the circle, connect to a down-comer at the left. This view show the top of the bucket off

in such a way that the molten iron from the cupola could be poured dicectly into the mold of the foundry without reheating. In the further development of this idea a steel works to pour the molten steel directly into the molds of the automobile parts and without reheating is a necessity, but this step has been reserved for the future. At present one of the blast furnaces has been completed and blown in, and the second one will be added shortly, possibly before this is placed in the reader's hands. Ore docks and ore handling equipment have been ready for some time, and the by-product coke plant was put in operation in 1919.

The new Ford works are known as the River Rouge plant of the Ford Motor Co.,

being part of the organization. The site covers several thousand acres just outside of the western limits of Detroit on the River Rouge, three miles from the junction of that river with the Detroit River. Ground was broken for the plant three years ago but work was largely suspended during the war owing to the difficulty of obtaining material. Attention was centered during the war on the erection and operation on the same site of a shipbuilding plant for the Government in which the submarine chasers known as the "Eagles" were built for the Navy Department. With the completion of the Government contract, the Eagle plant has been converted into an automobile body building plant. Work on the two blast furnaces was started in September, 1918, and piling is now being driven for the two additional blast furnaces originally contemplated. The erection of one of these furnaces will probably be started late this year. No definite plans have been announced as yet for the proposed steel plant.

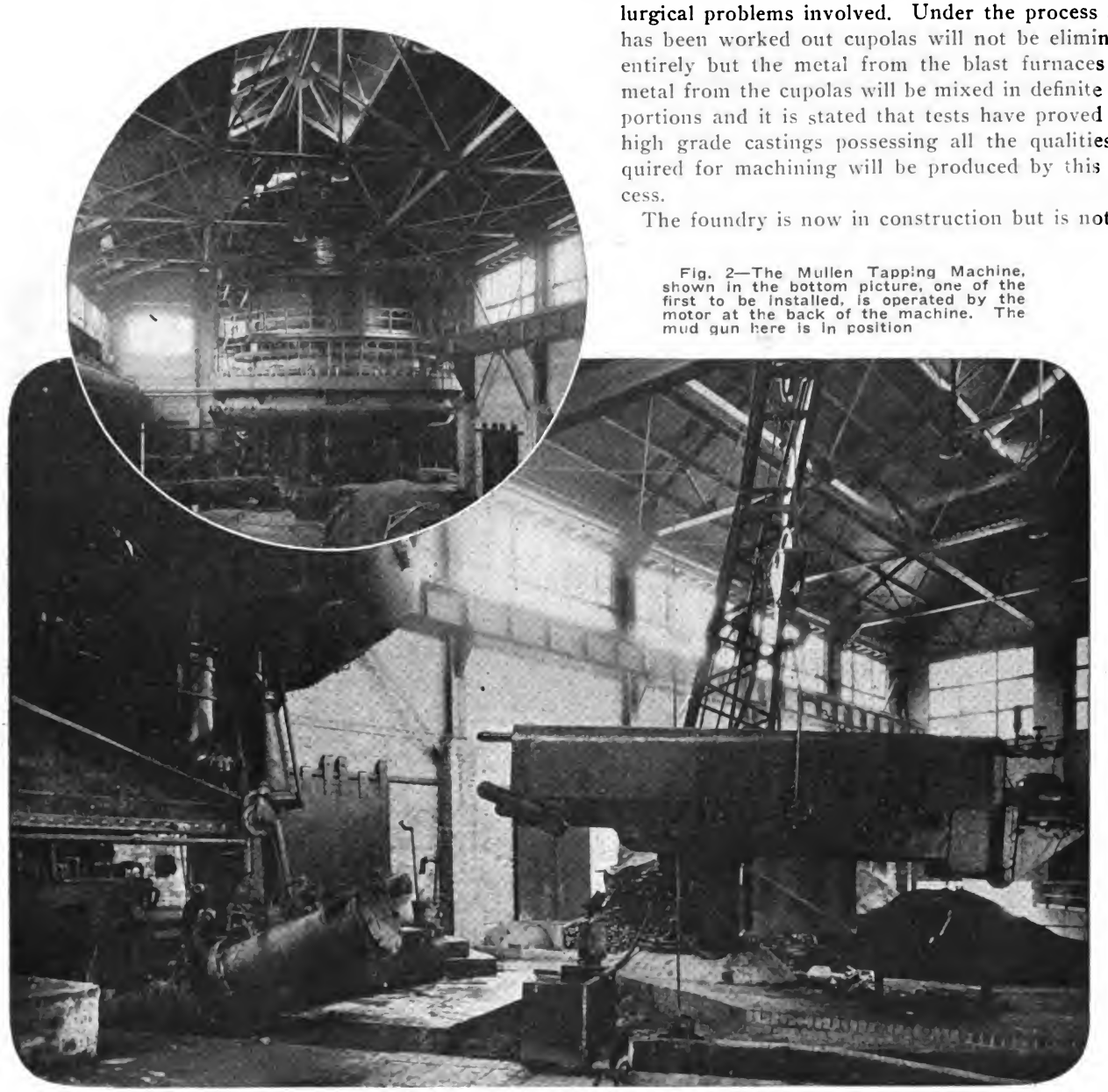


Fig. 2—The Mullen Tapping Machine, shown in the bottom picture, one of the first to be installed, is operated by the motor at the back of the machine. The mud gun here is in position

A predominating feature of the blast furnaces, and in fact of the whole plant, is that no expense has been spared in construction. The design of the furnaces provided for the heaviest and most substantial type of construction for all parts, and the engineers have aimed to make the furnaces and the equipment complete and modern in every particular.

More than usual interest has been taken in the Ford blast furnaces because of the announcement that the company planned to pour hot metal directly from the furnaces to the molds in the foundry, eliminating remelting the pig iron in the foundry cupolas. Mr. Ford believing that this could be accomplished, some time ago set his engineering and foundry departments to work on the metallurgical problems involved. Under the process as it has been worked out cupolas will not be eliminated entirely but the metal from the blast furnaces and metal from the cupolas will be mixed in definite proportions and it is stated that tests have proved that high grade castings possessing all the qualities required for machining will be produced by this process.

The foundry is now in construction but is not expected to be ready for operation before fall. It will be of very large capacity, the building being 1188 ft. long and 660 ft. wide. It will be equipped with 18 cupolas arranged in three batteries of six each. Metal from the blast furnaces will be taken to the foundry in ladle cars and poured outside the foundry wall in a 30-ton ladle or hot metal container, one of which will be provided for each battery of cupolas. From this ladle, 1,500 to 2,000 lb. of the furnace metal will be poured into a foundry ladle and the ladle taken to the cupola and the required amount of cupola metal will be added. Track

scales will be provided for weighing both the blast furnace and cupola metal as it is poured into the ladle. The cupola charge will consist largely of scrapped castings, sprues and gates from the foundry, borings and scrap steel from the present automobile body plant. A large machine shop will be erected adjoining the foundry for finishing the castings.

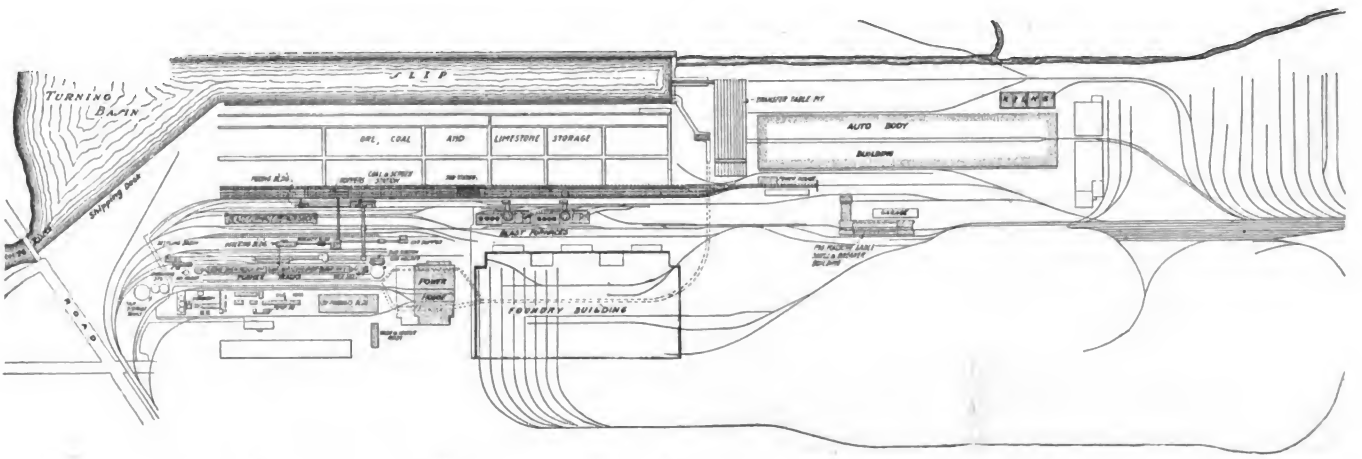


Fig. 3—General plan of Ford's River Rouge plant showing disposition of various buildings and other units

The completed blast furnace is 92 ft. in height from the iron notch to the top platform and the diameter at the bosh is 22 ft. 9 in. The capacity from the tap hole to the bottom of the bell is 32,000 cu. ft. The diameter at the hearth is 17 ft. and at the stock line 16 ft. 6 in. The angle of the bosh is 78 deg. 11 min. The lining is 3 ft. in thickness in the shell, being reduced to 27 in. at the bosh. Besides the bosh cooling plates there are 11 rows of plates above the mantel, these being carried one half way up the inwall above the mantel. These are set back approximately 18 in. from the inside lining. The stock line is protected by wearing plates. These are heavy cast iron sections 8 ft. high and they are water cooled by means of cooling pipes cast in the cast iron section.

The foundation of the furnace is a concrete mat 8 ft. in thickness laid on piling and above this mat is a brick foundation 9 ft. 8 in. in thickness. The columns and column bases are anchored to the foundation with anchor bolts to hold them in alignment. There are six hollow cast iron columns and the diameter of the column circle is 30 ft. The average column diameter is 24 in. The circle pipe rests on the mantel and the bustle pipe is suspended from the mantel by vertical rods running through cast steel brackets riveted to the bustle pipe. The bustle pipe is 2 ft. 9 in. in diameter inside the brick work and 4 ft. 7 in. inside the shell.

The hearth jacket is a 1½ in. riveted steel plate and is protected on the inside by cast iron segments 4½ in. in thickness, pipe coils being cast in the segments. Between the outside steel plate and the inner cast iron plates is 4 in. of grout. The hearth jacket is 24 ft. 4 in. in diameter and 10 ft. 9 in. high, extending from approximately 2 ft. above the cast house floor to the bottom of the column bases or 6 ft. 7 in. below the iron notch.

There are 12 tuyeres. The tuyere jacket is a 1¼ in. riveted steel plate 21 ft. 6 in. in diameter and 4 ft. 10 in. wide. The tuyere jacket and hearth walls are cooled by copper cooling plates.

The bosh is reinforced with five heavy steel butt strap bands above the tuyere jacket, these being 12 in. wide and 1¼ in. thick, supported by cast steel brackets from the tuyere jacket, making a self-supporting unit. The bosh is cooled by nine rows of copper cooling plates. The mantel is of the flat horizontal plate type, being built up of sections of plate with stiffening angles and heavy built straps.

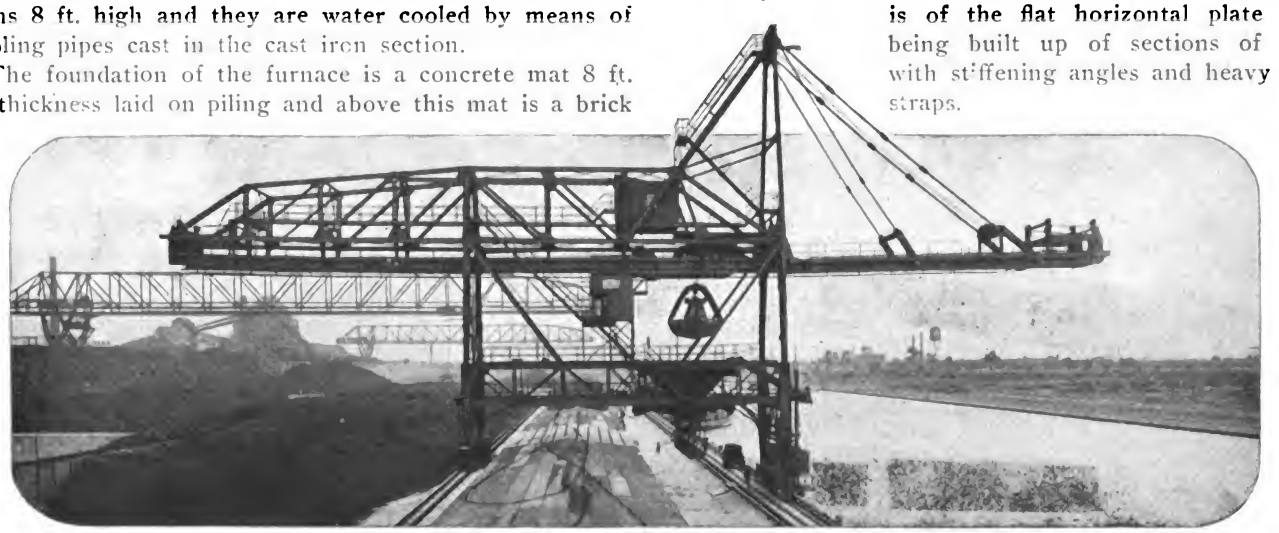


Fig. 4—The unloader for ore and coal at the Ford River Rouge plant with two ore bridges appear in background

The furnace shell is built of ¾ in. plate with double riveted butts on the vertical seam and single riveted laps on the girth. The bottom ring is 1 in. in thickness and the other rings ¾ in. thick. The top ring is heavily reinforced with angles to take care of the top platform brackets. Several railings placed 6 ft. apart encircle the furnace starting above the hearth, these being provided as a safety measure.

The shell is surmounted by Kennedy cone type top. At the top of the cone is a cast steel saddle made in four sections. This saddle carries the top hopper which is a solid steel casting. The hopper is 13 ft. in diameter at the top and 11 ft. 6 in. at the bottom and 6 ft. deep. The bell is 12 ft. 3 in. in diameter and the angle of the bell is 53 deg. The large bell is hung on a cross-head which is supported by two rods operated by a hydraulic cylinder.

There is a change from the usual design of Kennedy top in the arrangement of the uptakes. Instead of having four cast steel outtake elbows running down under the platform, the four uptakes for taking off the gas are turned up through the platform and connect together at a point 25 ft. above the platform through cast steel fittings into two downcomer branches. High uptakes were provided in order to hold the stock in the furnace better. The uptakes are 4 ft. in diameter and the downcomer branches

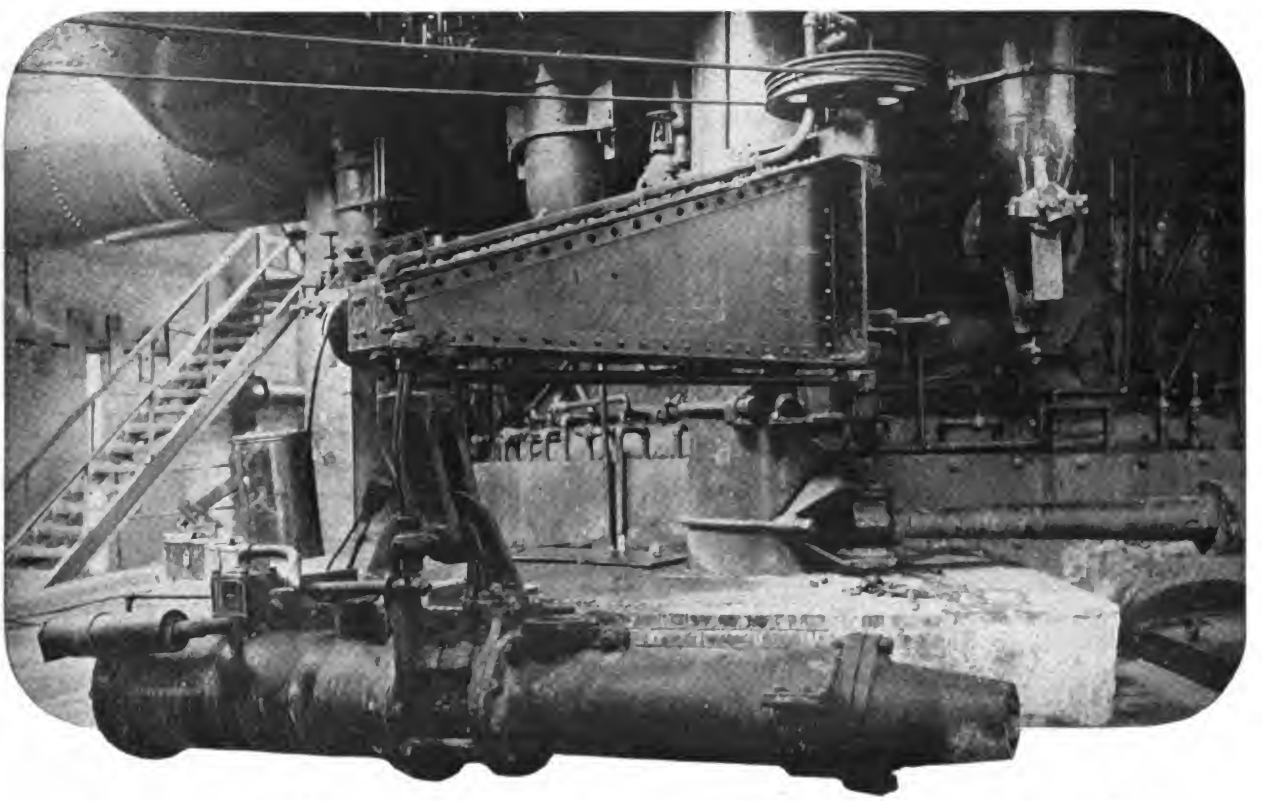


Fig. 5—The view of the mud gun and its operating device covers also the bosh construction and tuyere stocks

4 ft. 6 in. in diameter. The bleeder valves are provided, one at the top of each pair of uptakes.

The two downcomer branches lead into the side of a dust-catcher and the gas leaves this catcher at the top. From the dust-catcher the gas is carried through a battery of 12 Kennedy centrifugal whirlers arranged in four parallel sets in series of three. From these whirlers the gas passes through a manifold 7 ft. 2 in. in diameter leading to the dry gas cleaner, and from the cleaner the gas is delivered into a clean gas manifold of the same diameter, and from this to the stoves and boilers. The gas is cleaned by passing through mats of steel wool, which are automatically cleaned, and the flue dust is discharged into hoppers beneath. A set of 5 ft. standard Kling quick operating goggle valves is provided for cutting off the dry gas cleaner so that the gas may be sent to the stoves or boilers without a second cleaning. The original plans called for the installation of a gas washer, but the dry cleaner was substituted. The checker openings in the stoves are smaller than in ordinary practice, and for this reason stoves require that the gas be unusually clean.

The Kling-Weidlein dry gas cleaner is a six unit cleaner. A second six unit cleaner of this type is being erected in connection with the second furnace. The installation of this cleaner was decided upon after an inspection at the works of the Carnegie Steel Co., Youngstown, where the first cleaner of this type was put in operation some time ago. The cleaner is of steel plate construction. Some of the advantages that led to its adoption in preference to a wet gas cleaner are that with its use the sensible heat of the gas is retained, its power requirements are very low, being approximately 4 h.p. for the automatic operation for the entire equipment of the six units as compared to 80 to 100 h.p. given as the power requirements for a wet washer, no water for cleaning as compared with 2,000,000 to 3,000,000 gal. per day required by a wet washer, settling basins are eliminated and pollution of water in the river is avoided. The cleaner was installed by Arthur G. McKee & Co., Cleveland.

Bleeders are provided on the ends of the stove and boiler gas mains and there are mushroom valves for cutting off each furnace from the boiler gas main. There is but one boiler gas main for both furnaces, and mushroom valves are provided for use in cutting off one furnace when only the other furnace is being operated.

There are four stoves for each furnace, 24 ft. in diameter and 100 ft. in height and with a heating surface of 100,000 cu. ft. each. The stoves are of the two-pass side combustion type and have a special design of 2 x 12 in. checker flues. A special type of brick is used in these flues. The brick are 3 x 6 x 16 in. in size with ½ in. recessed ends to provide the 2 x 12 in. flues. The stoves are designed with small flues to get a large amount of heating surface in order to provide the high blast heat that has become the more general blast furnace practice. The

stoves have 2 in. asbestos installation on the sides and Sil-o-cel powder on the tops of the domes. All heating blast mains and bustle pipes are insulated with asbestos board between the brick and shell.

The chimney valves are of the mushroom type with water cooled seats. The hot blast valve is a hollow steel valve of welded steel plate construction and works on a bronze seat. This valve and the seat and stem are water cooled.

The stoves are equipped with Kennedy gas burners. A specially designed Kennedy gate valve is used for cutting the cold blast from each stove on the cold blast line. The mixing pipe from the end of the cold blast main to the hot blast main is equipped with a McCarthy regulating and drop valve. The stoves are served by a brick lined steel plate stack with a bell type of base 190 ft. high and 18 ft. in diameter at the base and 8 ft. 3 in. diameter at the top.

The cast house is equiped with a 20-ton Pawling & Harnischfeger crane for general handling and a Mullen tapping machine and a Berg-Brosius clay gun. A track is provided on each side of the cast house, the hot metal track being on the east side and the cinder track on the west side. The metal will run in cast iron runners from the tapping hole to the ladle. There are six 75-ton Pollock and one 95-ton Treadwell ladle cars for taking the hot metal either to the pig machine or to the foundry for direct casting.

One end of the foundry is only 75 ft. from the cast house. A Uehling pig casting machine is provided. Above this machine is a special tilting trolley of 100 tons capacity built by the Morgan Engineering Co. for tilting the ladle. If the metal goes to the foundry, a Wellman-Seaver-Morgan gantry crane will be used for tilting the ladle in pouring the metal from the furnace ladle into the foundry receiving ladles. Cinder will be loaded into Pollock cinder cars and for the present dumped at a convenient point. Plans for the final disposal of slag have not yet been worked out.

The cast house is of unusually elaborate construction. It has heavy brick walls with red faced brick on the outside and wainscoting of fire brick on the inside. There are heavy sliding steel doors in each bay and above the crane runway and all around the building are factory ribbed glass windows in swinging steel Lupton sash, making the interior well lighted and permitting the cast house to be completely closed with the exception of the open roof monitor.

Extensive dock and handling facilities have been provided for handling ore, coal and limestone, for not only will ore be brought to the furnaces from the Lake Superior mines but coal and limestone will be shipped to the plant by boat from Lake Erie docks. A slip 250 ft. wide, 2614 ft. long and 25 ft. deep has been built on each side of which are concrete docks extending the length of the slip. At the point at which the slip runs into the river, there is a turning basin providing sufficient space for turning the largest lake freighter.

The ore and coal storage yard and the unloading dock are on the east side of the slip. The unloading equipment includes two standard Hulett ore unloaders built by the Wellman-Seaver-Morgan Co. and a Mead-Morrison coal unloader, equipped with 10-ton clam shell buckets. There is also a Mead-Morrison car dumper for dumping cars of coal shipped by rail. The three boat unloaders run on the same track along the dock. This track extends the full length of the dock and has a span of 70 ft. Ore, coal and limestone will be dumped from a cantilever back of each unloader into a trough 70 ft. wide and from this trough two bridges will distribute the raw material to the stock yard under the bridge or deliver it to transfer cars on the trestle. These are Mead-Morrison bridges with a 350 ft. span between the shear leg and pier leg and with a 115 ft. cantilever over the dock and an 88 ft. extension with a shear leg, making the total length of the bridge 523 ft. The bridge is served by a 10-ton man trolley which handles a 10-ton bucket.

The River Rouge has not yet been made navigable for large lake boats and until the necessary dredging is done to permit the bringing of cargoes to the dock ore will be unloaded at the dock of the Detroit Iron & Steel Co. and both ore and coal brought to the plant by rail and discharged from an overhung track that is carried on brack-

Fig. 6—The quenching car and the guide for directing the coke to the car

ets on the pier leg wall. One half of the storage yard is used for ore and the remainder for coal and limestone. In building the ore storage yard, piles were driven 4 ft. apart and above these was placed a reinforced concrete mat 2 ft. in thickness.

Ore, coal and limestone are delivered by the bridge into wide gage Hoover-Mason transfer cars are on the high line trestle over the bins which are in parallel line with the storage yard. There are three tracks on the high line. One is a three rail track, two rails providing the wide gage for the transfer cars working with the ore bridge and an inner rail making the same track a standard gage track for handling rail shipments of ore. Coke is brought from the screening stations at the coke ovens to the furnace coke bins in specially designed Hoover-Mason scale transfer cars.

The stock bins for ore, coke and limestone are of reinforced construction of standard Hoover-Mason design. There are 32 bins divided longitudinally into two rows. The west row of bins are for ore and those on the east of furnace side are for coke and limestone. Each bin has a capacity of 200 tons of ore or 60 tons of coke. The bins have electrically driven revolving drum gates.

Ore, coke and limestone are delivered from the bins into double compartment Hoover-Mason scale larries for hauling to the skip bucket, each compartment having a capacity of 15,000 to 20,000 lb. of ore. The larry cars are of bottom dump hopper type, dumping into a chute that feeds into a skip bucket which has a capacity of 6,000 lb. of coke. The revolving drums that feed from the stock bins to the larry cars are solid plate on the ore side and perforated on the coke side, giving the coke an extra hopper under the skip bucket to take care of a spillage when the larry cars are being dumped and this feeds from the hopper into a Link-Belt conveyor which carries the material up to an overhead hopper which delivers it back to the scale larry cars.

The skip incline is a self-supported structure 190 ft. long, inclined at 50 deg. from the horizontal and has a single track. The single skip bucket is suspended underneath a specially designed carriage. The bucket and carriage are counterweighted and are operated by an Otis specially designed gearless hoisting engine, the armature of the motor being directly connected to the drive of the hoisting engine. The skip bucket is suspended under the carriage on a rod and bell and at the top of the furnace the bucket is seated on a small hopper over the large bell. The further travel of the carriage lowers the small bell at the bottom of the bucket, allowing the stock to be discharged into the large bell. When the bucket is not on the top of the furnace, a hydraulically operated sliding cover plate seals the top of the furnace. this being the latest Kennedy design. After the stock is discharged into the large bell, the bell is actuated by hydraulically operated cylinders.

At the top of the rod that supports the bucket there is a gear and when the bucket runs to the bottom of the skip, this gear on the bucket supporting the rod, meshes with a rack operated by hydraulic cylinders, revolving the bucket to insure uniform distribution of the stock in the furnace.

The hoisting engine is supported on a tower half way up the skip. This tower also carries the counterweights for the skip car and carriage. The skip hoist operated on a load of 15,000 lb. of ore at 600 ft. per min. The contral for the skip hoist is in the operator's house situated on the ground level at the skip pit. The same operator also controls the bucket turning mechanism sliding cover to the top, and the large bell operating cylinders.

One of the special features of the plant is that in addition to having indicating pyrometers, pressure gages, etc., at convenient locations, numerous instruments are provided for recording the stove temperatures, hot blast temperatures. furnace top temperatures, furnace top pressures, gas pressure before entering and after leaving the cleaners, stock line levels, etc., a complete record being kept of all temperatures and pressures. In addition, a complete time record is kept of all motions in connection with the furnace charge so that at the end of the day the superintendent has a full record of the various furnace operations. Every time the skip bucket goes up, the bucket is turned at the bottom, the sliding cover is opened and the bell is lowered, a record of these various movements is made by the different instruments in the instrument room. A record is also kept of the temperature of the cooling water before and after going to the furnace, these being recorded both on the intake and outtake. It is stated that nothing nearly as complete in the way of recording instruments has ever been attempted in the operation of a blast furnace. The various recording instrument are located in a separate instrument house, being mounted on a slate board.

Cold blast for the stoves is supplied by three General Electric turbo-blowers located in the central power house which is now under construction and which will supply power for the foundry, machine shop and also other power requirements. Vertical Wheeler condensers are used for the turbo-blowers. The latter are mounted on structural steel foundations. Steam is supplied to the turbo-blowers by boilers in a temporary power house. Four water tube boilers of 2,647 h.p. normal rating will be installed in the new power house by the Ladd Boiler Co. These are said to be the largest single boilers ever built. The boilers will be fired with both blast furnace gas and powered coal, each having a burner for each fuel. A plant for pulverizing coal is being erected adjoining the power house by the Pulverizer Fuel Corporation. A belt conveyor will convey coal from the coke breaker building of the coke plant to the pulverizing plant, a distance of 600 ft. The pulverizing fuel will be elevated above the roof of the turbo-blower section of the power house and carried in 16 in. screw conveyors to the main boiler room.

Cold blast lines from the turbo-blowers to the stoves are riveted pipe 42 in. in diameter. At each blower several valves provide an interchangeable valve system for connecting different blowers to one or the other furnace and at each blower there is also a Mesta multi-port check valve to protect the blowing engine from the liability of excessive back pressure due to gas explosions.

The water supply for the furnaces is taken from the upper end of the slip passing through stationary and revolving screens. It is carried through a tunnel 12 ft. in diameter to the main power house where the tunnel divides into two branches, one entering the turbo-generator room and the other the turbo-blower and pump room. Corresponding discharge tunnels leave these rooms and join at the north end of the coke plant, the tunnel discharging into the river below the coke plant. Water for each blast furnace is suppiled by an Allis-Chalmers centrifugal pump with a capacity of 3,600 gal. per min. One spare pump is provided. Each 12 in. supply line for the furnaces is provided with a twin basket Elliot strainer. Water connection is made to a water tank for use in an emergency should the water pumps get out of commission. The daily water requirements of the two furnaces for cooling purposes is 10,000,000 gal. The pumping head is 200 ft. and the distance the water is pumped is 550 ft. to furnace A and 880 ft. to furnace B. Compressed air is supplied by a temporary air compressor plant in the ore yard.

The coke oven plant consists of two batteries of Semet-Solvay 15-ton coke ovens of the regenerative type, 120 ovens in all. These will carbonize 2,500 tons of coal per day and their daily output is 1,800 tons of coke. It is expected that when the blast furnaces and foundry are in full operation these will consume all the coke suitable for use. The surplus coke in small size will be disposed of as domestic coke. The plans provide for two additional batteries of coke ovens and the erection of these ovens may be started late in the year.

The coal is conveyed by a belt conveyor, either from the coal storage yard if shipped by boat or from the car dumper if brought by rail. The conveyor takes it to the

Bradford breakers where it is given a preliminary crushing. From the breakers conveyors carry it to four mixing bins, each of 250 tons capacity. Each bin is equipped with a steel flight apron conveyor over which the flow of coal can be regulated. This permits the mixing of different kinds of coal in any desired proportion. The apron conveyor delivers the coal to pulverizers in which the fuel is pulverized until 85 to 90 per cent of it will pass through an ⅛ in. mesh screen. The plant is provided with No. 8 Williams pulverizers.

A belt bucket elevator receives the coal from the pulverizers and conveys it to the top of the charging bins. It is charged into the ovens with Semet-Solvay electrically operated charging cars which differ from most cars of this type in that they have four entirely separate compartments. The guide that directs the coke from the oven to the quenching car is so located that the fuel is discharged at a sufficient distance above the platform on the coke side to permit the placing of a rail about 30 in. high along the plaform, eliminating the danger of workmen stepping off the edge of the plaform and falling into the quenching car.

When the quenching car is loaded it is moved to a quenching tower located at the extreme end of the ovens where the coke is quenched by water from two rows of sprinkler pipes above the car. This tower is about 75 ft. in height, built of brick and has an open top from which the steam escapes. The quenching tower was provided for two purposes; one is that with the steam carried well up into the air through the tower a cloud of steam near the ground is avoided and the danger of accidents to workmen walking along the tracks in the vicinity of the ovens by reason of having their view obscured by a cloud of smoke, is eliminated. The other reason for the tower is that it keeps the steam away from the iron work of the ovens and consequently protects this work from corrosion. The quenching car was built by the Atlas Car & Mfg. Co. and the coke pusher by the Wellman-Seaver-Morgan Co.

After the coke is quenched and drained the quenching car is brought back on the same track at the rear of the ovens and coke is delivered to the coke wharf 200 ft. long that extends along the ovens on the opposite side of the track. From the wharf the coke is fed to a belt conveying system that carries it over screens and picking belts for a general sizing and preparation. A belt-boom conveyor loads foundry coke directly on railroad cars as it is produced, thus avoiding dropping the coke and breakage. Other coke is discharged into bins from which it is delivered to cars by gravity chutes. Coke for the blast furnaces is delivered to the electrically operated transfer cars that convey it to the high line trestle and discharge it into the coke bins.

The gas driven off in coking is collected into two separate mains, one main for rich gas and the other for lean gas. The rich gas is sold to the Detroit City Gas Co. to which it is delivered by a booster cross compound compressor supplied by the Hooven-Ovens-Rentschler Co. The lean gas is used for fuel at the ovens and for various uses in other parts of the plant. Gas is exhausted from the ovens by General Electric turbo units.

In the by-product plant ammonia is recovered by the direct sulphate process as ammonium sulphate, which is used as commercial fertilizer. The ammonium sulphate is precipitated in saturators of Semet-Solvay design by passing the oven gas through a bath of 600 deg. Baume sulphuric acid. It is dried in centrifugal driers and shipped in bags or bulk as commercial sulphate.

Crude light oil is recovered from the gas and the surplus remaining from the gas enrichment is washed and ..ctionated into refined light oil through a light oil and benzol apparatus of Semet-Solvay design. This refined light oil is mixed with gasoline, making motor benzol.

The yield per ton of coal that is being obtained in the coke ovens and by-product plant is 5,600 su. ft. of gas at 640 b.t.u. and 18 candle power per cu. ft., 2 gal. of motor benzol 25 gal. of ammonium sulphate and approximately 8 gal. of tar.

At present the Ford Motor Co. is using the entire production of motor benzol but in the future expects to have a surplus which will be placed on the market. Some of the tar produced is now being sold but the company expects later to use its entire tar output for various purposes within the plant.

Body Builders Unusually Busy and Prosperous

A strike of men employed in the automobile body building trades in Cincinnati settled only recently after five months of idleness in most of the body building plants, has created a peculiar situation in the industry. One body builder was approached to take on a very special job for a relative of the head of one of the big automobile factories. It was a carte blanche order and the builder could have the body to any design or description he chose as a chassis would be forthcoming to fit it, rather than the other way around.

He said he couldn't take the job for any earlier delivery than a year from May 1, as he had closed his books on the 1920 business. This condition may not be universal among body builders, but it is certain that the excessive demand for all types of bodies, both closed and open, and especially the former, coupled with the fact of the strike, has put the bodymakers in a position where they don't have to look for business. There is a five months' period of idleness when everything was going out and nothing coming in, that has to be paid for.

British Planes Licensed Under Wright Patents

Recently published newspaper articles concerning the suit of the Wright Aeronautical Corp., owner of the basic Wright airplane patents, against the Interallied Aircraft Corp. have resulted in misunderstanding as to the right of the Interallied Aircraft to sell its Avro and Sopwith airplanes. The Final Decree of the court in that suit did prohibit the further sale or use of these airplanes, but the Interallied Aircraft Corp. has made an agreement with the Wright Aeronautical Corp. so that all the planes which the Interallied Aircraft now has and is selling are licensed under the Wright patent and the Interallied Aircraft has the absolute right to sell them.

No purchaser or user of the airplanes sold by the Interallied Aircraft has any reason to apprehend any legal difficulties with respect to the Wright patent. Purchasers or users of unlicensed foreign airplanes do run the danger of becoming involved in expensive patent litigation, but the planes of the Interallied Aircraft are guaranteed licensed under the basic Wright patent.

Ball Bearing Lubrication Very Important

Two of the cardinal points in successful ball bearing operation, according to H. R. Trotter, Hartford, Conn., are the design of such a type as will permit the formation and preservation of an oil film, and the selection of a lubricant that will provide a film of maximum strength with a minimum of internal friction. With a ball bearing, he said, the problem is not so easily understood, but the important points to be remembered are: The coefficient of friction is practically constant throughout wide ranges of loads and speeds; metal-to-metal contact (an oil film) is only possible at very high speeds when slippage may take place; the coefficient of friction is lower in an unlubricated ball bearing (at light loads and moderate speeds).

The first point is of course generally known, but the conclusion to be derived from this point has not been stated before, to his knowledge, namely, the impossiblity of an oil film between balls and races. A number of curves were shown indicative of the difference in the coefficient of friction of a plain bearing and a ball bearing. Curve A showed the change of friction coefficient of a plain bearing under constant load and varying speed and indicated that a satisfactory oil film is not formed until a certain speed is reached. Curve B gave the friction coefficients of a well-made ball bearing, and showed that the friction loss of a ball bearing is practically constant throughout wide ranges of speed. If an oil film were formed between balls and races, curve B, he said would possess the same general characteristics as curve A.

It should be evident that plain bearings and ball bearings possess such radically different characteristics that a true comparison is impossible. It naturally follows therefore that practically all the accumulated experience of the lubricating engineer is of little value when analyzing ball bearing operation.

"The use of a lubricant with ball bearings," he said, "is necessary to protect the highly polished surfaces of the balls and raceways and to minimize the slight friction between the balls and the ball retainer. The small amount of friction between balls and retainer can also be minimized by careful design. The principal requirement of a ball bearing lubricant is chemical neutrality. The lubricant used must not contain over 0.10 per cent acid or alkali. There are many commercial lubricants on the market which come within this limit, but very few are acceptable because of their tendency to develop acid with age or when operating at high temperatures.

"Most of the high grade oils can be used with safety, but many of the lubricating greases, while suitable for general purposes, are a positive menace to succesful ball bearing operation, not because of poor material used in the manufacture of greases, but because of the lack of scientific mixing methods. The manufacturer is in no way to blame for this condition because he is making grease for general commercial use and not for ball bearings. There are now on the market a few greases manufactured especially for ball bearings, but with one exception all those tested by the writer have proven worthless and clearly indicate the maker's ignorance of the requirements.

"Experience shows that the most satisfactory lubricant for ball bearings is a highly refined mineral oil having the proper viscosity and cold test for the installation. Greases should be used only where the operating conditions require viscosities greater than obtainable with mineral oil.

"Whenever a ball bearing is operated at high speeds it is not advisable to run it submerged in a lubricant, and provision should be made to supply the oil from a pressure system. If such a system is not available, good results may be obtained by a large sight-feed oil cup. A few drops of oil per minute is all that is required.

"At moderate speeds a heavy oil will generally give better results than a light oil. The substitution of a heavy oil for a light oil will generally result in a decreased operating temperature. This peculiarity may be explained by the fact that when the bearing is running at the actual operating speed, less opposition is offered to the rotation of the balls by the oil because of the inertia of the oil. In addition there is less churning and frothing with their resultant air pockets. Air pockets in a lubricant act as insulators and prevent the transmission of the heat generated to the outer casing where it can readily be dissipated."

All mineral oils used on ball bearings, the speaker said, should be highly refined, filtered and contain a minimum amount of acid, alkali or sulpho compounds. In order to insure the use of such oils, Mr. Trotter suggested specifications which were given in detail. Most of the high grade mineral oils, he said, conform quite closely to the specifications as given.

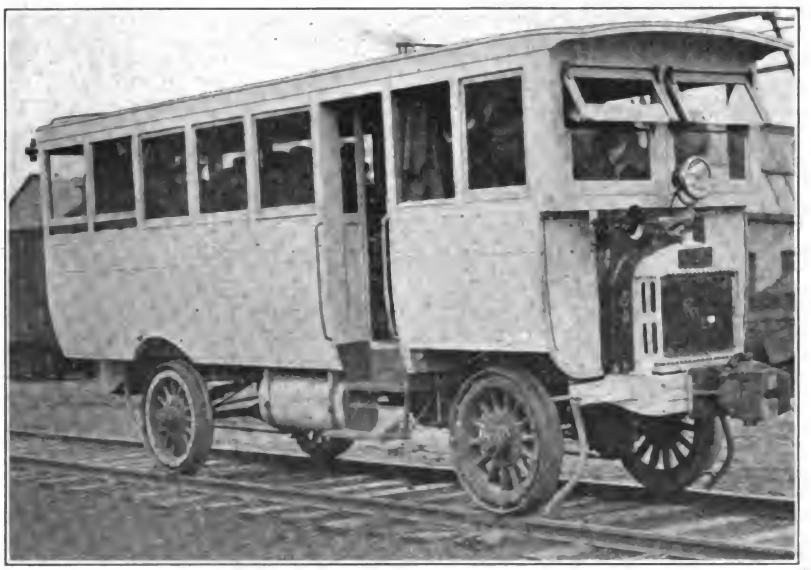
"In connection with lubricating greases," Mr. Trotter said, "the problem is more difficult. Many of the greases now on the market are entirely satisfactory for general purposes, but lack certain characteristics which experience shows to be highly important for successful ball bearing lubrication. A large number of greases contain lime soap as thickeners, a few are of the soda-soap type, while others are a combination of both. The lime greases are valuable in that they can be used without harmful results where moisture is present. Their consistency, however, is more easily changed by heat than greases of the soda type." The speaker then gave in detail a specification for grease lubricants suitable for ball bearings.

"Graphite, despite its unctuous qualities," he said, "cannot be regarded as a true lubricant. It can, however, be used with success in plain bearings as it fills in the interstices in the bearing surfaces and allows the true lubricant to operate efficiently. A modern well-made ball bearing with mirror-like finish has, however, practically no interstices in the balls and raceways. A perfectly finished ball shows no scratches when magnified 100 diameters and furthermore were there irregularities present, graphite would not eliminate them as there is considerable difference between the sliding action of a plain bearing and the rolling action of a ball bearing.

"Graphite, moreover, has a tendency to pack in the ball retainers and raceways, and a bearing which has been lubricated with graphite grease generally has a distinct wavy appearance in the ball paths. A recent brief test of a grease containing graphite revealed the fact that while the graphite did not pack in the raceways and the wavy ball paths were absent, the complete raceway presented a burnished appearance quite different from that obtained by the use of ordinary greases. The graphite packed hard and could be removed by dipping in gasoline.

"The use of graphite in ball bearings cannot therefore be regarded as beneficial and its application is purely a question of economics. Its use in ball bearing automobile tranmissions and rear axles is advisable only if the increased efficiency and life of the gears offset any possible harmful effect on the bearings."

Widening the Field of Utility of the Motor Truck



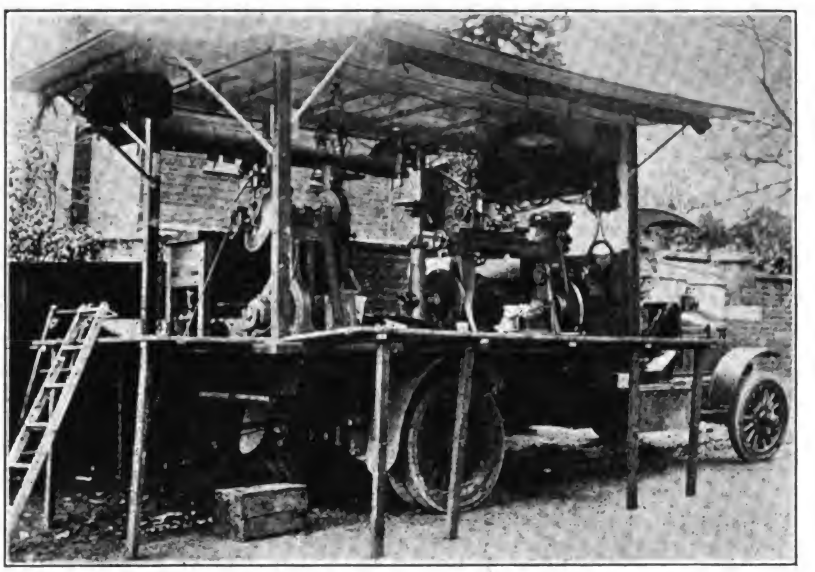
The following pictures display motor trucks at work hauling liquids as railroad passenger cars, lumbering, hauling cotton, as traveling machine shops and dumpers. In these and other ways the truck is saving time, money and effort for many progressive firms

Above special Ward-Lafrance chassis with tank body for handling milk in bulk. The 500 gals. can be emptied in 2 mins. saving much time over cans. Similarly, with cleaning interior

At left, F. W. D. truck being used by Palatine, Lake Zurich & Wauconda Railroad between Wauconda and Palatine, Ill. Capacity 30 passengers, plus trailer with freight. Very successful and climbs a 7 per cent grade without trouble

Below, huge logs hauled by Frank Johnson, Seattle, Wash., using Diamond T chasis with special bogie truck wheels and pole connection. This work is impossible in any other way, besides being very quick and economical

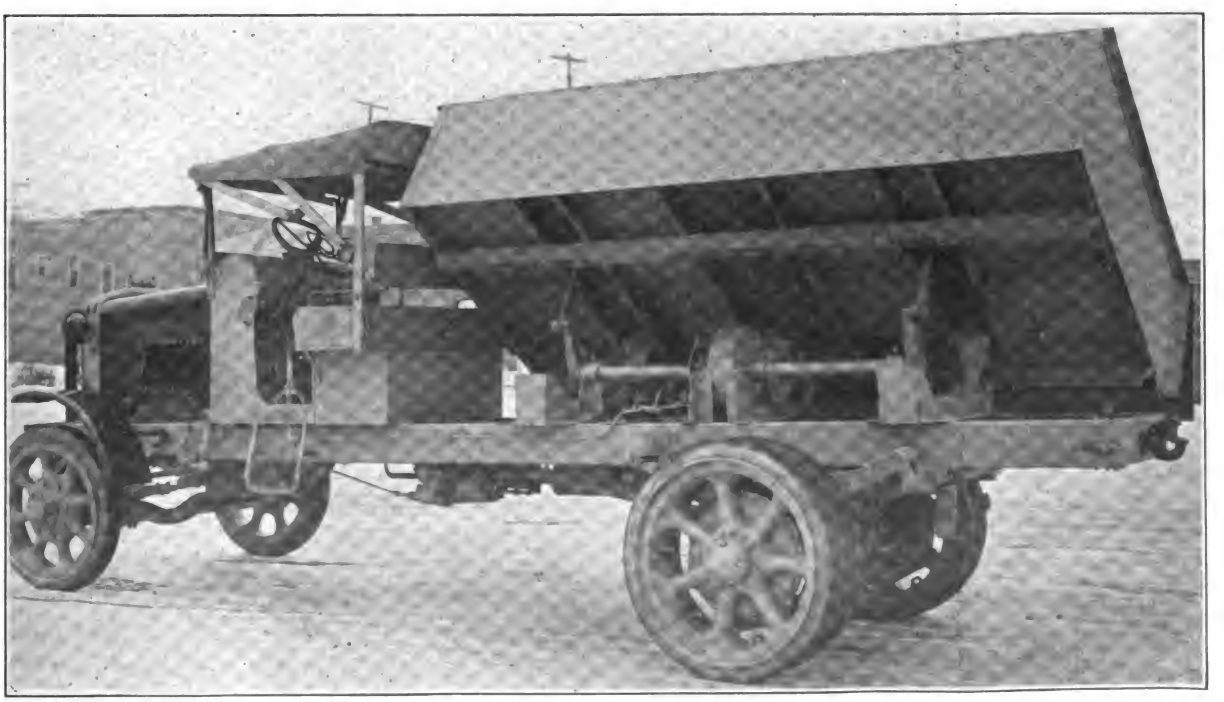
Hauling cotton has been a difficult task until now because of its weight and bulk. This Columbia truck and specially constructed trailer handle 30 bales per load, with a total weight of approximately 8 tons



Truck fitted up as a traveling machine shop, and set up for use "Somewhere in France." This is mounted on a Pierce-Arrow chassis of 5 tons capacity. England and France used many thousands of these

New type of side dumping body designed by and for Denby trucks. The first of these was for Bill Hayes, Detroit contractor. Entire space back of driver is available for load; dumps clear of roadway; will clear wet or stick material through whole side opening

Subsequent pictures will indicate other ways in which the motor truck field is being widened



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The Mixed-Up Labor Situation

MANUFACTURERS, farmers and other employers of labor all over the country are complaining of the shortage of labor, especially common labor. According to the farmers, their shortage of help is due to the higher wages, shorter hours and easier living of the cities. At the same there is a great shortage in the cities, where the various employers accuse one another of stealing their men away at higher wages. Uncle Sam too, is blamed for many business men say he still has in unnecessary service many thousands of workers who could and should be released for other business, and that this would serve a double purpose, reduce the amount of money to be raised by Federal taxes and give more workers.

According to William H. Barr, president of the National Founders' Association, the trouble lies not alone in any one of these agencies, but purely and simply in the fact that there is no immigration. He said in part recently: "As the situation exists today we are about 4,000,000 workers short due to the dwindling of immigration. There is not enough manpower to go around; wages have gone up; living costs have mounted apace and the situation of which the farmers complain—that their help and their children have been lured to the cities by higher wages—has resulted. Not only that—the migratory and seasonal labor, composed in a large measure of Finns, Italians, Poles, Portuguese, Syrians, Belgians and Bohemians has practically been non-existent for there have been a job and a half in industry, and at higher wages, for every man who wants a job.

"Taking up the question of the increased cost of commodities which the farmer has to buy, that too, is attributable to the acute shortage of manpower in the industries that supply the farmers' needs. Until recently the foreign born workmen provided more than half of the unskilled labor in the basic industries, especially in those lines purchased by the farmers, such as agricultural machinery, lumbering and lumber products, textiles and shoes.

"The foreign born provide nearly three-fourths of the labor in the leather and tanning industries, to quote from statistics on foreign born labor recently announced by the Inter-Racial Council of New ork. The leather goes to the tanneries from the packers and the price is influenced by the increased cost of the labor in the packing industries where most of the workers are foreign born. The cost of labor in the tanneries has gone up and that in turn influences the price of leather to the shoe manufacturer. By the time the leather reaches the farmer in the form of shoes, it has taken on several added costs and the farmer pays a high price. The situation holds true for other commodities.

"The American farmer today is buying metal products at an increase of 186 per cent; clothing at an incease of 243 per cent; lumber at an increase of 197 per cent. He has every reason in the world to complain. But so has the manufacturer for in each of these industries immigrant labor has represented from fifty to seventy-five per cent of the entire unskilled labor force and this labor is more and more difficult to get.

"Production has fallen off, costs have mounted and the manufacturer has had to raise the price of his product in order to provide himself with a margin between what he pays for his raw materials and his labor and what he gets for his product.

"The solution of the problem I believe, lies in an adequate supply of new labor—not a deluge of labor. We need immigrants who are best adapted to the needs of America who are most easily assimilated into our national life. There is no other source except immigration, from which to draw the necessary manpower to fill the gaps in primary labor.

"Immigration needs to become a bigger national issue; a more selective process needs to be enforced in admitting immigrants; the subject should have no political aspect at all and it needs to be dealt with without favor either to capital or labor.

"Until that is done one of the very fundamental reasons for the difficulties of the farmers, the difficulties of industry and the difficulties of the public who are paying skyrocketing prices—and largely because the labor supply is inadequate—will not have been removed."

If Mr. Barr really believed all this just as he is quoted, he and the other members of the association who complain of this acute shortage much have been greatly pleased more recently when the arrivals at Ellis Island for a number of consecutive days were much greater than the facilities provided for receiving them, so much so that a hurry call had to be sent out for the removal of some other departments temporarily housed there during the dullness of war times. These have now been removed, facilities again are at a high level. Let the foreigners come as fast as they like. A news despatch from Italy tells of the reservists from the United States now being ready to return, so that some 70,000 out of the whole 100,000 are now ready to come back to these shores. If the same situation exists in other European countries, the middle of summer and early fall should see this movement in full swing.

Universal Test Engine Produced*

New Design Should Accelerate Proper Cylinder Development and Produce Reliable Scientific Data Which Could Be Used as Basis of Future Designs

ENGINEERS generally will admit the desirability of increasing the efficiency and improving the design of motor cars and trucks, and especially of engines, as the most important units. This is not alone desirable but under existing circumstances, is a necessity if considered from the viewpoint of fuel economy alone. The rapidly increasing number of cars and trucks, upwards of 40,000 a day, adds to the amount of fuel necessary. Even at the modest figure of 300 gallons per vehicle per year, this means an increment each day of 12,000,000 gallons a year to the present totals. When one considers the present shortage with storage decreasing a million barrels a month it is apparent that if a test engine construction of any kind will produce data from which a more economical engine can be built, engineers will welcome it with open arms.

*Abstracted from paper by Glenn D. Angle, Eng'n. Div., Air Service. Cuts by courtesy of Aviation and Aeronautic Engineering, New York.

It is admitted that reliable and accurate scientific data on engines and engine performance is lacking, despite the fact that there are many reputable engines now in use and giving excellent performances daily. For one thing, this data is not available because of the many influencing factors which vary from one design to another. Nevertheless something should be done as this lack of data not alone hinders scientific progress but leaves the engineer in a quandary in selecting the design or combination of designs to produce the desired results in a most efficient manner.

As a rule the mechanical efficiency of an engine is comparatively high. This is particularly true of the airplane engine which is accurately constructed of very light weight parts made from the highest grades of material. Apparently little opportunity for improvement is afforded in this direction, but the marked differences between weight-power ratios, fuel consumptions, and other im-

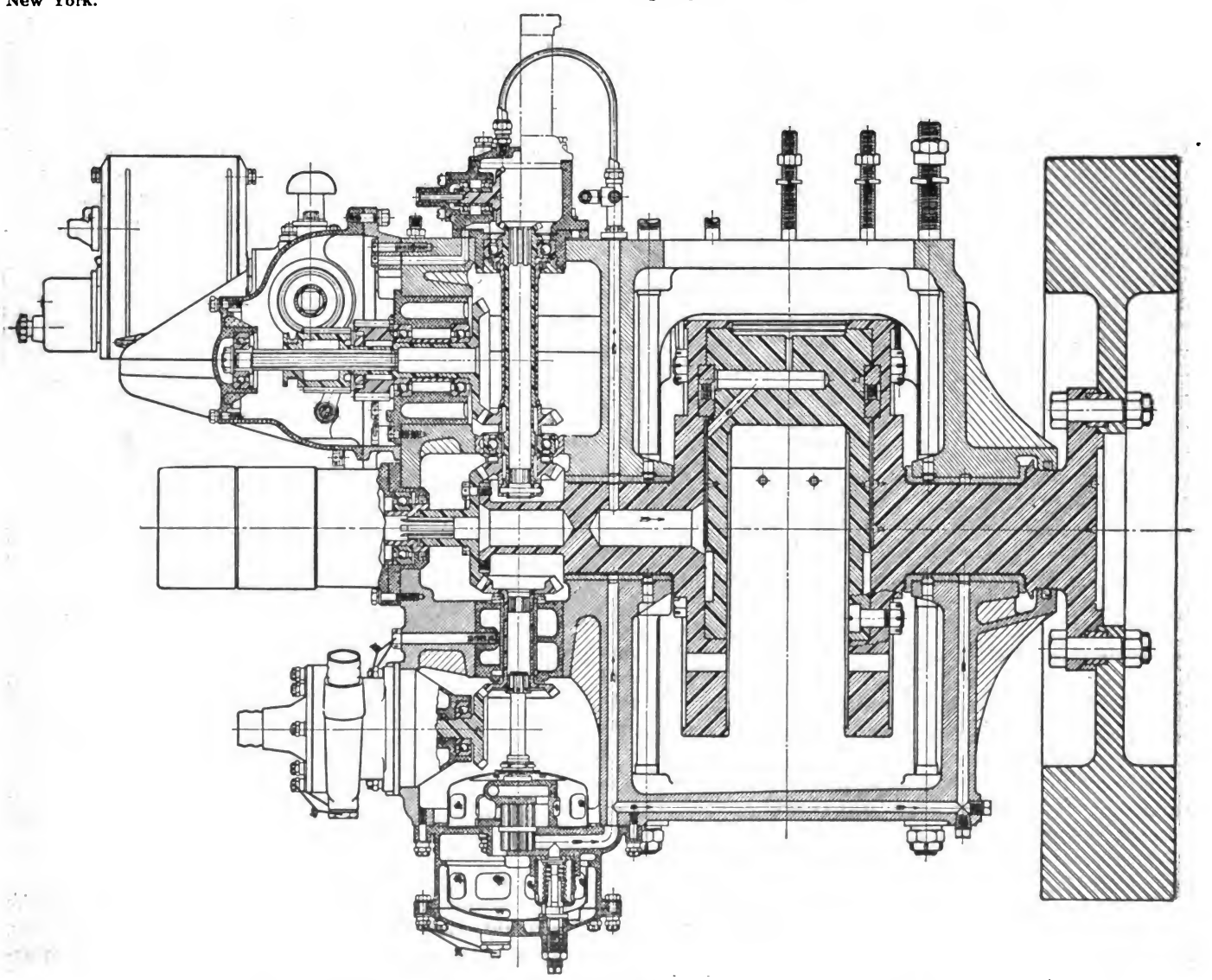

Fig. 1—Longitudinal cross section of Universal Test Engine Showing Construction

portant performance characteristics clearly demonstrates the need for extensive development along other lines. One of the most important of these is undoubtedly the design and construction of the cylinder and its adjunct components.

Heretofore the development of a cylinder has been carried out on a complete engine, but seldom produces satisfactory results as quickly desired. Moreover for multi-cylinder forms such a method of development obviously entails considerable expense. Under normal conditions one cylinder of an engine functions exactly like the others and improvements in one effect improvements in all; hence cylinder development can be carried out just as successfully and with much less difficulty or expense on a single cylinder engine constructed for the purpose. A few test engines of this sort have been built, but in every case were intended only for one design and the field of experimentation was thus limited to that particular cylinder. Whenever it was required to develop other sizes or designs, new test engines had to be constructed. The universal test engine surmounts this difficulty as it is so designed that most any cylinder can be tested on it but before describing this engine it would be well to briefly explain the specific reasons for its design.

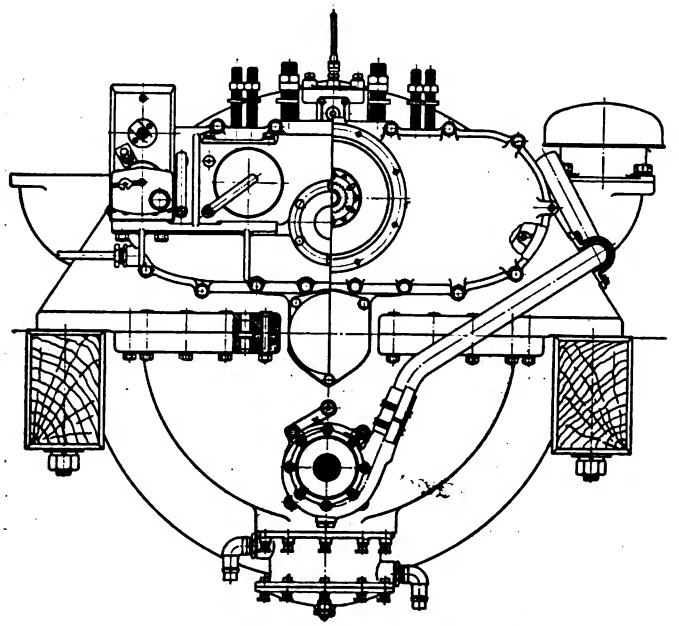

Fig. 2—Timing end view of universal test engine

Immediately following the signing of the armistice, the organization of the Governmental Experimental Airplane Station at McCook Field, Dayton, O., began to rapidly adjust itself to the new duties, which included principally the perfecting of certain airplanes and engines then on hand, and as a technical division to accumulate data and prepare designs for future construction which should place this country in its proper rank in the science of military aeronautics.

Since engine development should precede plane development by one year or more, it was clearly evident that a good engine program was of the utmost importance. Only a few American designs were considered of military value and so besides immediately undertaking the necesary improvements on these engines the design of other types found to be needed was also placed under careful consideration.

For future designs it was very apparent that the former methods of development were inadequate and the desired results could hardly be expected with the limited amount of money available for this work. It was therefore decided to construct some sort of engine which would allow for accurately testing different sizes and designs of cylinders under varying conditions, so that the performance and consequently the valve of any particular design could be determined before constructing an entire engine. Furthermore the Engineering Division could become acquainted with the exact performance of any cylinder submitted by the manufacturer of an experimental engine prior to purchasing the complete unit.

No knowledge concerning any former construction of this sort existed; consequently the practicability of building an engine for these purposes demanded serious consideration. It was not until after the entire situation had been very carefully analyzed that design and construction was actually undertaken. It was proposed to obtain as wide a range of bore-stroke combinations as practically possible, provide for the operation of all types of cam and valve mechanisms, and at the same time allow for quick interchangeability of parts and easy means for testing.

The salient feature of the engine as it was finally worked out is the wide range of cylinder adaptation. Cylinders can be tested which have bore diameters from 4 to 8 in. inclusive, and strokes from 4 to 10 in. inclusive. This range includes all sizes of airplane engines that are at present in practical use, and allows for experimentation with large cylinders if future requirements so demand. Compression ratios can be readily varied, in most cases it being quite easy to obtain a range from 4 to 10. Obviously high compression ratios can not be used continuously near the ground, but provision was made for such cases when it might be desirable to determine the effects of different compressions at various altitudes by testing a cylinder in a vacuum altitude chamber. All other outstanding features can best be explained in the description of the various parts which immediately follows.

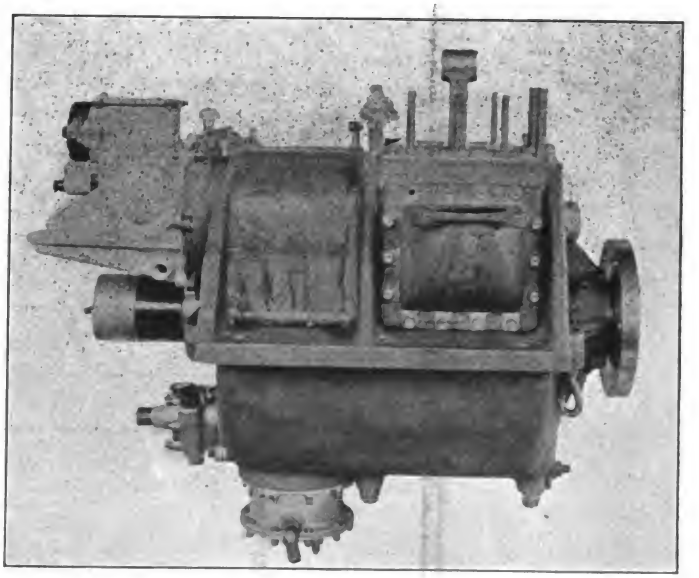

Fig. 3—Side view of universal test engine

Crankcase

The crankcase is made in halves and divided along the horizontal crank center-line in the conventional manner. Both upper and lower halves contain the crankshaft bearigs and the two are held together mainly by four long and

sturdy bearing studs together with the four shorter bearing bolts. There are also additional bolts through the outer flanges which give an oil tight joint. The walls and in fact all sections are made extremely heavy. The casting which is made of iron, produces a very rigid frame member and should prevent serious damage in case any rotating part fails.

The crank and gear compartments are separated by a wall so that the gears are not exposed to the crankcase vapors. On either side of the crank compartment are large hand holes which permit inspection and the adjustment of connecting rod bolts. When the engine is in running condition these inspection holes are covered by breather elbows retaining screens which are to prevent oil vapor from being blown out or any foreign substance from entering the interior.

Crankshaft

A great deal of thought had to be given the design of a crankshaft for this engine on account of various lengths of strokes which were to be used. Individual crankshafts could have been made for each length of stroke, but this undoubtedly would have introduced difficulties later on. Bearings would have to be refitted almost every time a shaft was changed, and a conventional shaft design in order to be strong enough for the large bore-stroke combination, would not be well proportioned for the smaller combinations. Furthermore the attachment of counterweights to every shaft would each time introduce vital design problems.

The built-up crankshaft construction shown on Fig. 6, eliminates the disadvantages referred to and has another feature in that it serves to supplement the action of the regular flywheel and thereby helps to maintain a more uniform speed of rotation.

The crankshaft assembly consists of three major parts. The two end portions include the main journals internally attached to the large discs which have eccentric recesses for receiving the intermediate piece. One end portion has a flange for attaching a flywheel and the other a flange for a bevel gear which drives the various auxiliary

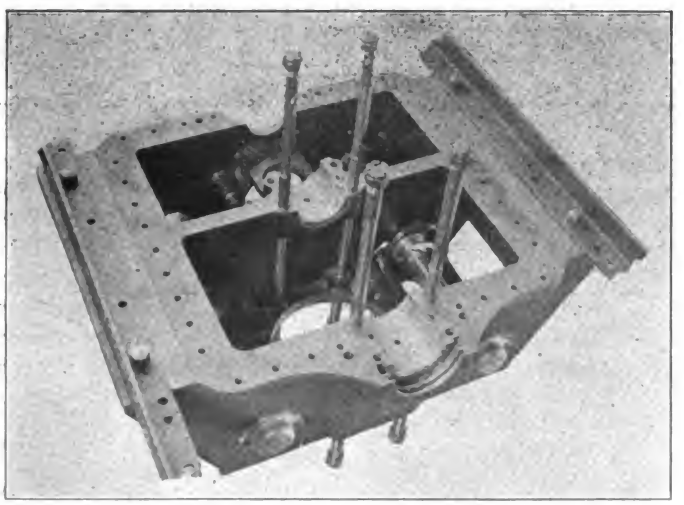

Fig. 4—Upper half of crankcase showing through bolts

units. The intermediate section comprises a crankpin on the ends of which are eccentrically formed similar and integral discs of the proper diameter to fit flush into the recesses provided in the larger discs of the end sections. The eccentricity of the recess is the mean of the maximum and minimum crank radii required to give strokes previously specified. By angular adjustment of the intermediate section it is clearly evident that varying crank radii can be readily secured.

The three crank sections are held together as one as-

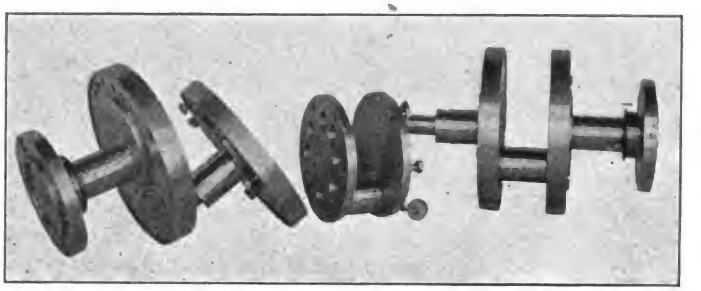

Fig. 5—Built-up crankshaft construction showing all components

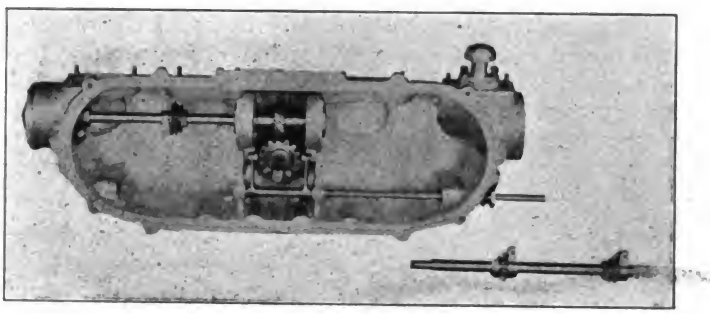

Fig. 7—Interior view of magneto housing

sembly to a total of 12 bolts, 6 on each side. These bolts have countersunk heads, set in flush to the inner surfaces so as to avoid any interference with the connected rod and are retained by slotted nuts and cotter pins. The bolts are not in shear as the driving torque is carried by blocks or dowels which fit snugly into small recesses on both sides. To facilitate removal each dowel is provided with a tapped hole.

Counterweights are bolted on the crankpin side of the large discs of the end sections by means of holes provided in those portions outside the eccentric recesses. The holes are unevenly spaced so that it becomes impossible to incorrectly attach counterweights from some predetermined location. The weights are of such proportions and the centers of gravity are so located from the crank center that the crankshaft assembly in addition to being in static balance provides for the balance of half of the reciprocating inertia forces. As is generally understood partial balancing of this sort on a single cylinder engine can be accomplished only at the expense of introducing an unbalanced component of equal magnitude along the horizontal. However as a result the forces are least if considered in every direction.

A variable throw crankshaft is apparently very difficult and expensive to produce, but once made it has an indefinite period of usefulness. And when supplied with an additional intermediate section for strokes in half inches, it serves for testing purposes much better than would fourteen or in other words the equivalent number of crankshafts necessary to give that many stroke lengths. Even without any special tooling the first crank shaft of this design was so accurately machined that when assembled it had much better bearing alignment than the average crankshaft made in one piece.

Connecting Rods

It became necessary to provide for more than one length of connecting rod on account of the limits to which a piston can overrun the cylinder skirt but it was found that only one rod was needed for each even inch stroke length. The body of the rod for each particular length of stroke was established by the section required to keep the stresses within safe limits with the largest diameter cylinders which were likely to be used and also clear the skirt of the smallest cylinders, whose diameters in each case should not be less than the stroke length.

Since the crankpin diameter is never changed, the crankpin bearing is the same for all rods and make of sufficient length to satisfy all conditions. The upper end of the rod is likewise made amply large and a bushing inserted to give the desired diameter of piston pin bearing. The width of the upper end is limited by the length of bearing required in the smallest piston that would probably be used with each stroke and by careful analysis it was found possible to so proportion these bearings that at no time were practical unit bearing pressures exceeded.

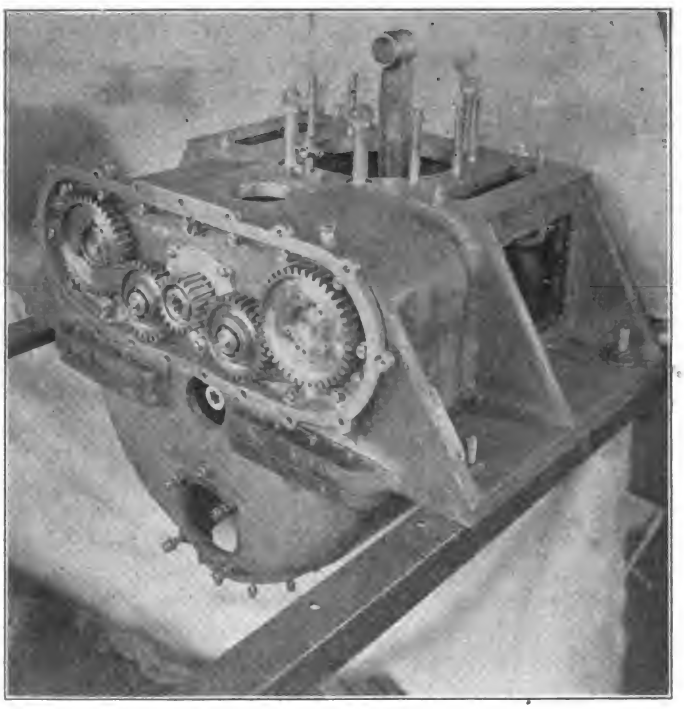

Fig. 6—Timing end with magneto housing removed

Camshafts

It was necessary to provide two camshafts in order to test all types of L or T head, or in fact any cylinder designs whose valve gear is operated through push rods from a camshaft mounted in the crankcase. These camshafts were symmetrically located on each side of the case and at a distance from the center sufficient to allow for operating the valve gear of the largest cylinder which could be tested. The shafts are driven through spur gears as will be noted from Fig. 7. An idler gear is mounted on a stud between the driving and driven gears, and can be easily removed when the particular camshaft which it drives is not to be used. The cam shaft gear is held to a flange on the shaft by three screws. By providing a certain different odd number of holes in each piece a very fine degree of adjustment for timing purposes is had.

The shaft is supported in three split aluminum bearings which are assembled onto the shaft before it is inserted into the crankcase from the end. When the assembly is in place the bearings are held from turning by the hollow studs, through which oil is supplied under pressure.

That part of the shaft extending into the crank compartment is splined for the purpose of driving cams. Individual cams of any desired shape or size having the proper splined hole may be attached. These are held in the correct longitudinal positions by spacing sleeves which slip over the outside of the splines. The whole assembly is then clamped together by means of a nut drawn up tightly against the steel collar which serves as the rear bearing of the camshaft.

Push rod guides are usually of special design depending of course upon the particular requirements. The push rod guide housings are bolted on top of the crankcase over a hole directly above the camshaft. When these housings are not to be used the holes are covered by plates.

Overhead camshafts are to be considered as a part of the cylinder design and therefore need no description here. However attention should be directed to the fact that the scheme for attaching cams is again carried out even so far as to use the same size of splines, thus making it possible to adapt the same cams in either place.

Flywheel

The purpose of the flywheel as is quite generally known is to contribute toward smoother running and lower rotative speeds, and comes as a result of storing the energy created during periods of high torque to compensate for the low torque periods. We have in this engine the possibilities of comparatively high and low torque magnitudes and also a wide speed range if considered as controlled by the so-called limiting piston speeds. A flywheel having a sufficient moment of inertia to handle the greatest torque periods, if made very large in diameter, would undoubtedly have prohibitive peripheral speeds in certain cases. It was found possible however after several trial computations, to satisfy all conditions with only two sizes of flywheels. These were so designed that at no time should the engine be prohibited from running at its lowest speeds more than 300 r.p.m.

Lubrication

Lubrication is of the force feed dry sump type, oil pressure being maintained by a slightly altered Liberty oil pump mounted on the lower part of the crankcase. The only alteration on the pump is the addition of an exterior adjustment for varying the pressure of the relief valve spring. This provides simple means for regulating the oil pressure which is maintained in the line serving the crankshaft journals. Sufficient outside connections were incorporated so that oil could be led to any one or all of the camshafts, the tachometer gear housing, the gears and bearings used in conjunction with driving all of the various units and also to an oil gauge.

Ignition

Either battery or magneto ignition may be employed. A Liberty generator is supported on the crankcase and driven through splines at the end of the crankshaft and when not in use is to be replaced by a cover plate which fits its mounting flange. Distribution for battery ignition is taken care of by magneto replacement units mounted on the magneto base flanges.

The gear case cover provides space for mounting and

driving four magnetos or four magneto replacement units as desired. It is reasonable to believe that as cylinder bore dimensions are increased the use of more spark plugs per cylinder should improve performance as a result of the better flame propagation. By supplying at least four spark bosses per cylinder it will be possible to verify the relative values of the different numbers of sparks. Also the proper location of spark plugs in any particular cylinder design may be determined by running tests with plugs in various positions. It is a comparatively simple matter during the test of cylinders using dual ignition to have both bagneto and battery systems connected up and by switching from one to the other note the effects and make comparisons as to the merits of the two systems under identical conditions. It is also proposed in connection with this engine to run tests to determine the values of various intensities of spark.

In order to derive full benefit from multiple ignition it becomes important to have the sparks occur simultaneously. All magnetos therefore should be advanced together from a common point and the advancing apparatus should have no slackness in its movements. All magnetos are driven through bevel gears from cross shafts whose squared ends engage with a central and permanently mounted shaft having an integral spiral gear. The angular positions of the three in line shafts are varied by sliding the driving spiral gear forward and back on the driving splined shaft. The driving gear is operated by a yoke which is pinned to a small shaft extending just outside of the housing for hook up to an instrument board.

The cross shafts on either side of the center can be readily removed from the ends by first dismantling the covers which retain their ball bearings. This feature is important as two shaft and gear assemblies are supplied in order to operate megnetos having either crankshaft or half crankshaft speeds of rotation.

It will be noted from the interior view of the magneto housing shown on Fig. 8 that special means have been provided for accurately adjusting the magneto timing for spark synchronization. The magneto driving gear is not fastened to the armature shaft, but instead floats on a hub that is keyed to this shaft. The drive is taken through the two adjusting screws which are to be screwed up and locked in the correct position against an extension provided on the back of the gear.

When certain magnetos or magneto replacement units are not used the hole through which these units are driven must be closed by a cover plate. This plate is held in position by a flat spring which at other times is turned back out of the way in a vertical position.

Cooling

For testing water-cooled cylinders, circulation is maintained by a centrifugal water pump identical to the one designed for the 4 cylinder Liberty engine. The outlet water from the pump is piped just beyond the first external crankcase rib, and from here connections are quite easily made to any desired point on a cylinder. In most every case it will be found that the capacity of this pump is greater than necessary; so in order to assimilate the conditions under which a cylinder is cooled as a unit of a multi-cylinder form, means for regulating and measuring flow can be incorporated just outside the cylinder inlet.

When testing air-cooled cylinders the water pump should be temporarily replaced by a special cover plate designed for this purpose. An air blast produced by a suitable blower is then directed against the cylinder walls for cooling. If suitable equipment is available some very valuable data in regards to air cooling can be obtained in connection with regular cylinder tests.

Tachometer Drive

Whenever the dynamometer testing equipment does not include a tachometer one may be attached and driven from the engine. The driving attachment is incorporated at the end of the gear and driving shaft shown mounted in the small housing on top of the crankcase directly above the gear compartment. This housing has three possible positions, allowing for drive toward the end of the engine, as shown on Fig. 2 or toward either side.

When camshafts are used the tachometer gear housing cover is in place and connected to the oil line for an original source of oil supply to the entire gear compartment. A flange containing a tube, which acts as the lower part of the telescoping housing around the camshaft, is substituted for this cover whenever overhead camshafts are used. Oil is then supplied to the gear compartment by the overflow from the camshaft housing.

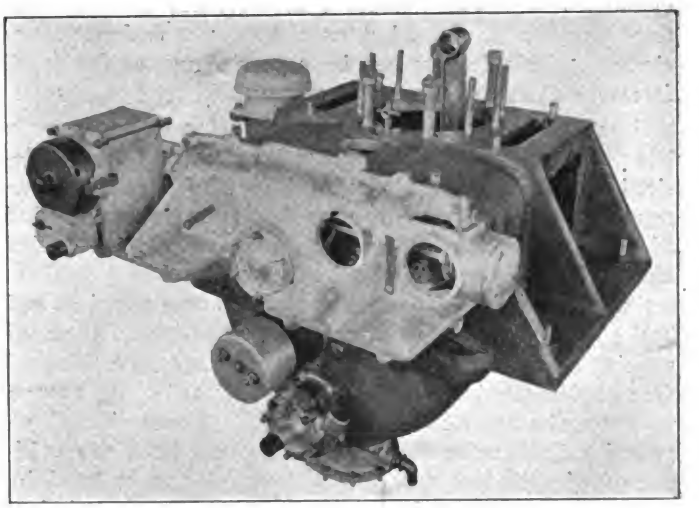

Fig. 8—Assembly showing magneto housing, oil pump, water pump and generator

Overhead Camshaft Drive

Overhead camshafts are always driven through bevel gears. The driving pinion is keyed to a vertical shaft having splines at its lower end to engage with the vertical hollow shaft mounted in the case. Three lengths of vertical camshaft drive shafts are all that are needed to take care of the variation in height of camshaft above the top of the crankcase as influenced by cylinder design and by differences in bore-stroke combinations and compres- by differences in bore-stroke combinations and compression ratio. Since the camshaft housing is usually supported on the cylinder, the drive shaft housing can be made to telescope. This allows almost unlimited privileges in the matter of raising or lowering the cylinder for any purpose.

Compression Ratios

As hereinbefore stated compression ratios from 4 to 10 are possible. The ratios are varied by raising or lowering the cylinder in respect the crank axis, and in order to obviate any changes in a cylinder flange shims are employed. The crankcase has a large hole above the crank compartment in order to adapt cylinders of 8-in. bore. As a result each cylinder must be securely mounted on a special flange which fits the crankcase and is held down

by means of the long main bearing studs and six additional studs of smaller diameter. All of these studs extend above the case for some distance to allow for shimming.

It was found possible to obtain the desired range of compression ratios in comparatively small increments by the use of one or more of the six shimming plates of different thicknesses that were designed for this purpose. These shims which have the same shape as the cylinder flange are fitted over the studs before the flange is put into place. Calculations are always made to determine the compression ratios that will be had with the various shim combinations when used with any cylinder adaptation and are recorded for reference purposes during these tests.

The above description dealing with certain features of the Universal Test Engine explains fairly well the numerous possibilities afforded for cylinder testing. Any cylinder within the prescribed size limitations, if more or less conventional in design, can be adopted and moreover in such a way as to assimilate very closely the conditions under which it is to perform as a unit of some multi-cylinder type. The flexible characteristics are not confined to cylinder sizes, but extend over each functionary element. This feature has been carried out as far as all former indications seemed to warrant.

Practically all comparisons will have to be made on a basis of the type of cylinder construction and then if desired various cylinders compared for the purpose of determining the best construction for some particular kind of work. In a general way, cylinders must be classified and their performance judged accordingly.

Since the mechanical efficiency of this engine is low and brake loads are not in the correct proportion to those of multi-cylinder forms, it becomes necessary to reduce all data to indicated readings, which after all is the correct way to make these comparisons. After making due allowance for distribution the brake horsepower of any combination of cylinders may be approximately calculated by totaling the indicated horsepowers of that many cylinders and multiplying by the probable mechanical efficiency as would be found in other engines of the same type running at corresponding speeds.

One of the design factors which engineers seldom agree upon is the bore-stroke ratio. It should be possible after a sufficient number of combinations have been tried on this engine to make some kind of definite statement in this regard. Compression ratios are limited in a certain degree by the type of cylinder and the work to be performed, nevertheless these should be accurately determined for every case. The valve and cam design which ordinarily requires extensive experimenting can be easily worked out with full assurance that the design adopted is the best possible under the conditions. Ignition tests, particularly in regards to number and location of spark plugs, are simple to perform and the results should be conclusive. Tests on cooling whether by means of water or air, can be scientifically conducted and the data made applicable to the engine of which the cylinder belongs. Unless it is manifolding and gas distribution, there is apparently very little development work on cylinders which cannot be completely and accurately accomplished on this engine.

Two test engines were constructed in the shops at McCook Field and satisfactory tests have already been made on a few cylinders. One engine is kept running most of the time and when a test is finished, this engine is removed from the dynamometer for a new cylinder adaptation and the other engine takes its place. As a result of careful planning it is possible to so arrange the order of these tests that very little work is required in changing cylinders.

Several cylinder assemblies have been completed and are ready for test while a number of others are in course of construction. The results so far obtained leave no doubt as to the practicability of this procedure, either in developing one cylinder or obtaining useful data on cylinder design generally. As more tests are completed the easier it will be to compare the data acquired and arrive at conclusions which no doubt may have considerable influence on cylinder designs in the future.

Army Officers See Great Possibilities in Metal Plane

After a recent test at Bolling Field near Washington of a Larsen J-L-6 all-metal monoplane, Col. W. K. Wilson of the general staff went on record as believing that the all-metal plane opened up entirely new possibilities in the air. He said after the trial flights:

"The J-L-6 represents a new era in aviation. It is designed to secure the maximum safety, service and efficiency. The metal wings carry the gasoline tanks which have a capacity sufficient to keep the plane in the air for more than ten hours. However consumption of gasoline for a plane of this size is very low. The cabin is designed for the comfort of the passengers. There are four upholstered seats arranged similarly to the seats in a limousine. There is a door on each side of the cabin and is in glass windows which can be raised or lowered by the passengers.

"Behind the cabin there is a small compartment for baggage. During the flight the passengers changed seats at will, ate lunch and wrote letters. As an inspection plane for army officials the J-L-6 is ideal. The metal construction has a big advantage in that it is both fireproof and weatherproof and the possibility of developing this type into a very much larger plane with greatly increased carrying capacity makes its introduction very important to both commercial and military aviation."

Traffic Code Suggested for Pedestrians

The following code for pedestrians, suggested by a man with a sense of humor, nevertheless contains a lot of good sense, considering what the motorist in our larger cities is forced to contend with. The code as it appeared in the National Safety News is:

Rule 1—Pedestrians crossing boulevards at night shall wear a white light in front and a red light in the rear.

Rule 2—Before turning to the right or the left the pedestrian shall give three short blasts on a horn at least three inches in diameter.

Rule 3—When an inexperienced driver is made nervous by a pedestrian he shall indicate the same and the pedestrian shall hide behind a tree until the automobile has passed.

Rule 4—Pedestrians shall not carry in their pockets any substances which when broken will be apt to cut automobile tires.

Rule 5—In dodging automobiles pedestrians shall not run more than seven miles an hour.

Rule 6—Pedestrians must register at the beginning of each year and pay a license fee of $5.00.

Rule 7—Pedestrians will not be allowed to emit cigarette smoke on any boulevard in an offensive and unnecessary manner.

Rule 8—Each pedestrian before receiving his license to walk upon a boulevard must demonstrate before an examining board his skill in dodging, leaping, crawling and extricating himself from machinery.

Rule 9—Pedestrians will be held responsible for all damage done to automobiles or their occupants in collision.

Automobiles to be Advertised as Utilities

Passenger cars are an indispensable asset to modern business and will be merchandised with this appeal, according to action taken at the close of the Asosciated Advertising Clubs of the World Convention in Indianapolis the week of June 10.

The convention resolution on this subject showed that the important sales of the passenger car today are to the farmer, the doctor, the salesman and others using the automobile as economical transportation business. The business market for the passenger car is capable of great development, and advertisers are urged to make their copy appeal primarily to the man who will use his car as a defienite asset in his business as well as for recreation.

The resolution reads: Whereas, The automobile has come to be an essential part of the active life and progress of the American people and an indispensable adjunct to the business life of the farmer, the doctor, the traveling salesman and to commerce generally, and

Whereas, The automotive industry in Amercia now stands first among our finished products. and

Whereas, The need for emphasizing the economic usefulness of the passenger car as the modern means of transportation and for advocating its use on that basis is apparent, since we are faced in America with a possible shortage of goods and credits which will make greater economy in business necessary, therefore be it

Resolved: That advertising men in their merchandising campaigns relating to automotive products be encouraged to stress the utility of the passenger car and to appeal particularly to those buyers who will use the automobile as an efficient asset in the nation's economic life.

Automobiles Considered as Essentials

According to E. C. Stokes former governor of New Jersey and now president of Mechanics National Bank, Trenton, N. J., automobiles are essential parts of our national life. Writing to a friend recently. relative to the automobile industry and with particular reference to the action of some of the Federal Reserve Banks in classing automobiles as nonessentials, he said.

"It might be well to call the attention of the banking fraternity to the importance of the automobile not only as a factor in the necessary transportation facilities of the country, but as a contributor to one of the largest of our industries and a promoter of the happiness and morals of our people.

"It is a mooted question whether the automobile industry stands second or third in the country. If all the parts in connection therewith are included it ranks second. What individual banker has a right to say therefore that an industry which by common judgment of the people of this country has attained such proportions in our industrial life is nonessential? Burke said you cannot indict a whole people. No banking fraternity or government has a right to say that an industry of such size as the automobile industry, based upon the needs and requirements of the public is unnecessary and therefore unworthy of credit.

"The automobile is of immense value to the nation as a promoter of the spirit of contentment and as an effective suppressor of the spirit of unrest. No owner of an automobile, even though it be a passenger car, who is able to enjoy its use for his family or his friends, is likely to become a Bolshevist or a Communist. He favors the continuation of things as they are, because he has a means of happiness in his own possession and therefore is against any upheaval of the present social order.

"Next to the church there is no factor in American life that does so much for the morals of the public as does the automobile. Formerly the pleasures of life divided the family. The father had one avenue of recreation, the mother another, the children another. Today our roadsides are crowded with family picnic parties who carry their lunches with them and who take their outing as a unit. Any device that brings the family together as a unit in their pursuit of pleasure is a promoter of good morals and yields a beneficent influence that makes for the good of Aemrican civilization. If every family in the land possessed an automobile, family ties would be closer and many of the problems of social unrest would be happily solved. The banker who says that a device of this kind is a nonessential possesses a narrow vision and fails to see the far reaching influence it has for good. The automobile is one of the country's best ministers and best preachers."

New Officers for National Research Council

The National Research Council has elected the following officers for the year beginning July 1, 1920: Chairman, H. A. Bumstead, professor of physics and director of the Sloane physical laboratory, Yale University; First vice chairman, C. D. Walcott, president of the National Academy of Sciences and secretary of the Smithsonian Institution; second vice chairman, Gano Dunn, president of the J. G. White Engineering Corporation, New York; third vice chairman, R. A. Millikan, professor of physics, University of Chicago; permanent secretary, Vernon Kellogg, professor of biology, Stanford University; treasurer, F. L. Ransome, treasurer of the National Academy of Sciences.

The Council was organized in 1916 under the auspices of the National Academy of Sciences to mobilize the scientific resources of America for work on war problems, and reorganized in 1918 by an executive order of the President on a permanent peace time basis.

Increase in Gasoline Consumption

Domestic gasoline consumption in 1919 increased approximately 9 per cent over 1918 and fuel oil gained the same amount. Lubricating oil declined 2 per cent and kerosene 3 per cent. The amount of oil used by vessels engaged in foreign trade (bunker oil) in 1919 showed an increase of 116 per cent over 1918.

Highway Transportation's Relation to Increased Production

By GEORGE M. GRAHAM*

How Transportation Reduces Costs, Highways Not Carrying Their Share—War Emphasized Importance of Roads—Railroad Men Advocate Trucks

Concluded from Page 25, June Issue

THE trucks also tap the suburbs, bringing in freight in ample time for daily distance shipment in bulk, and saving anywhere from one to four days.

Every freight house has standard truck bodies which attach to the chassis.

When the railroad car comes in, the freight is quickly snatched from it and allotted to bodies destined for the various stations. Only five minutes is consumed in taking off one filled body and putting on another.

The service releases, in a year, 66,000 box cars from trap work for profitable distance haulage. The cost is $.80 per ton as against from $1.20 to $1.60 by previous methods.

Solve the terminal question, and you solve extravagant costs as well as time lost.

One expert, B. F. Fitch, President ol the Motor Terminals Company of New York and Cleveland, has said that the installation in the metropolis of a motor system similar to that of Cincinnati would save New York consumers $45,000,000 in freight costs yearly.

Many items of cost inseparable from railway freight can be eliminated when short haul shipment is made by truck. Included in these are items of boxing, crating, demurrage charges, teaming between terminal points, increased weight caused by boxing, and much incidental labor and clerical work in connection with billing, checking, tracing, etc.

All these economies exert their influence on production costs and volume.

Savings Effected by Otis Elevator Co.

W. J. L. Banham, General Traffic Manager of the Otis Elevator Company, presents a very interesting table, in which he shows how truck costs increase in proportion to the increased length of the haul.

	Road Miles	Freight Cost per 100 lbs.	Motor Truck Cost per 100 lbs.
New York	12	$ .88	$ .15
Passaic, N. J.	6	.88	.15
Paterson, N. J.	10	.88	.18
Trenton, N. J.	51	.88	.55
Philadelphia, Pa.	88	.98	.75
Bridgeport, Conn.	70	1.12	.75
New Haven, Conn.	87	1.12	.85
Providence, R. I.	214	1.12	1.15
Port Jefferson, L. I., N. Y.	71	.98	.75
Asbury Park, N. J.	46	.94	.45

10,000 Motor Haulage Lines

Ten thosand motor truck haulage lines are now registered with the National Automobile Chamber of Commerce by corporations or firms. This organization estimates that there are another 10,000 lines being operated by individuals, who own and drive the trucks. Several of the corporations have made investments ranging from $1,000,000 to more than $2,000,000.

We believe that to prove our ability to facilitate delivery is to establish our helpful relationship to production. We should, therefore, like specifically to point out some phases of our service in the four main types of production.

Foor may well be dealt with first.

Importance in Handling Food

In the United States 26,000,000 food producers are trying to feed themselves, 79,000,000 additional American citizens and many Europeans. It is an enormous task. It has been made harder by waste from inadequate distribution. No less an authority than Herbert Hoover has said that 50 per cent of the perishable farm produce in the United States rots on the ground because of the farmer's inability to get it to market.

Over American highways passes a volume and value of food products of astounding dimensions.

Agricultural crops, dairy products, poultry, produce and domestic animal production reached in 1918 an aggregate of more than $21,000,000,000. There were 5,638,000,000 bushels of cereal; 11,818,000 bales of cotton; 309,109,000 bushels of potatoes; 197,360,000 bushels of apples; 6,549,000 tons of sugar beets; 10,500,000,000 pounds of pork; 589,000,000 heads of poultry; 1,921,000,000 dozens of eggs; and 8,429,000,000 gallons of milk.

United States Senator Arthur Capper of Kansas points out that the motor truck is essential to the development of the agricultural interests of America and shows $70,000,000,000 to be invested in farms—a sum equal to the total of any three other industries that might be named.

Stimulating Food Production

Adequate transportation helps food production by exerting these four principal influences:

1st. Gives wider producing area.

2nd. Definitely lowers cost of foodstuff without detriment to farmer by saving much excess transportation cost. This is important, because under present methods the farmer gets but 35c for products which cost the consumer $1.00. This means that two-thirds of the $1.00 is expended in distribution.

3rd. Shortens time of transit to market, thereby increasing the farmer's producing hours on the farm.

4th. Assures the prompt arrival of perishable items at the door of the consumer when they are in best condition and command the highest prices.

Trucks are being applied to food distribution in varied ways. The farmer hauls for himself and his neighbors. Local transfer companies are entering the field, but the biggest development is in the organization of what have come to be known as rural motor express lines. The Highways Transport Committee made itself responsible rural motor express lines in operation, and some of them

*General Sales Manager, Pierce-Arrow Motor Car Co., Buffalo, and member Motor Truck Committee, Nat'l. Automobile Chamber of Commerce.
Address delivered at Eighth Annual Meeting, Chamber of Commerce of U. S., Atlantic City, April, 1920.

for this movement when, during the war, it was straining every effort to increase the food supply.

There are now known to be 3,000 regularly established involve a considerable investment. The number is constantly increasing. Their economies have not yet been reflected in any general decrease in food prices, mainly for the reason that the application has not become sufficiently general.

There are in the United States 6,361,502 farms. All over 80 acres could find profitable use for one or more trucks. Assuming the 80 acre farms to be but one-third of the total this would mean the use of 2,120,500 trucks, whereas actually not more than 78,000 are now assisting the farmer to market more food, in better condition and at lower costs.

Unwise Truck Legislation Hurtful to Public Interest

Many legislators have voted for legislation inimical to the motor truck from a feeling that they have served the interests of the farmer. No error could be greater. The motor truck offers a haulage economy. It performs its function more cheaply than the horse-drawn vehicle.

In reality the haulage of farm produce by motor truck is cheaper than haulage by team.

This statement has the support of the Department of Agriculture. The 1918 figures of the Bureau of Crop Estimates show the cost of hauling in wagons per ton mile as compared with motor truck haulage to be as follows.

	Wagon	Truck
Wheat	$ .30	$ .15
Corn	.33	.15
Cotton	.48	.18

Motor truck hauls from farm to shipping point averaged 11.5 miles while wagon hauls averaged 9 miles. Motor trucks made 3.4 round trips per day, while wagons made 1.2 round trips.

So valuable have been the results obtained from the movement of food over the highways by motor truck that the state of Maryland has delegated authority to its Director of Farm Products to maintain and operate motor lines along the state highways to and from markets and to maintain a service to and from terminals, docks and depots for the collection and distribution of farm products. New York state is investigating this subject. The Nebraska State Railway Commission has recognized truck haulage and established a price rating on 100 kinds of articles.

Some extraordinary economics have been achieved. Milwaukee gets its milk by trucks over concrete roads at a freight saving of 2c per quart, which means a saving of $1,000,000 yearly to the people of that city.

Trucks haul the Maryland peach crop to the packing plant where the product is loaded into waiting refrigerator cars. They thus act as a profitable feeder to the railroad spur on which the packing plant is located.

The movement is also spreading rapidly to live stock shipment.

In 1919 there were received in Indianapolis by motor truck, from nearby points more hogs than arrived by rail. For the year more than 711,000 hogs, 48,000 cattle, 63,000 calves and 59,000 sheep arrived by gasoline truck in far better physical condition and at a material saving over railway freight cost.

Not only is food production stimulated by highway transportation from the farms but mention should properly be made of the help rendered by motor trucks to plants which mill, preserve, produce, refine, refrigerate, retail and store various food products. These are vitally related to the great general scheme of production and distribution.

Insurance Against Railroad Strikes

A properly organized system of food transportation over the highways constitutes a national insurance against the results of railroad strikes. It means that the people are not dependent on one kind of transportation for the necessities of life. Railroad strikes will be fewer and their effects will be less distressing if we can turn to an alternative kind of food distribution.

In such emergencies the truck is always called on, even in its present state of only partial application. It was so in England during the railway strike, when all the food for London was successfully carried in motor vehicles. It was so in our own recent switchmen's strike. It will be so in future upheavals.

Why not therefore organize in advance for such contingencies so that the vehicle of the highway may ever be swiftly ready to protect the health and life of the community during the continuance of labor disputes?

Motor truck facilities are equally valuable as applied to the transportation of fuels.

It is true that the distance transportation of coal and oil is essentially a railroad function in specially built cars but in many stages of fuel distribution the highways play a most important part.

The great oil refining companies are without exception very considerable users of motor trucks.

Experence in the oil fields shows that expense is negligible where instant service is desired. The oil well is capricious and autocratic. It does not consider the convenience of its owner. It does considerately manifest itself near railroad tracks. It is likely to gush forth from the earth at most inaccessible points.

When the oil operator strikes a gusher he must speedily get his equipment placed or suffer loss. He buys motor trucks and—if need be—depreciates them at 100 per cent on the particular job being well able to do this if he can save time.

Many coal mines in this country have no railroad sidings. Coal and mine supplies must be moved by vehicle and in many cases the motor truck has been adopted.

Retail coal distribution is very largely a motor truck function and it is thus possible to serve many manufacturing plants not directly located on railroad spurs.

Transports All Kinds of Raw Materials

Motor trucks are being applied in the transportation of all kinds of raw material. They are used in mining copper, graphite, gold, lead, manganese, mercury, phosphate, salt, silver, sulphur and zinc.

Building materials, such as gravel, leather, lumber, cement and sand are all very largely handled and distributed by trucks. Immense lumber sections in the northwest, which otherwise could not be tapped are being reached by trucks.

Opportunities frequently arise in the cotton industry for using trucks to transmit the raw material from the fields to the gins, from the gins to the trains, and the bales from the railroads to mills.

The whole record of production of war supplies is filled with instances where trucks brought in raw material and

kept going plants that otherwise would have idled. One instance will suffice.

The American Woolen Company, largest of its kind in the world depended on a Boston trucking firm which delivered at its mills 12,000,000 pounds of raw wool in one year. This material went into the making of uniform cloth for the American army.

But it is especially in its relation to manufactured articles that the motor truck justifies itself as an adjunct to production. It discharges many functions. Its service begins when a building from which will issue production is being erected. It hauls away the dirt from the excavations, brings in materials for construction, delivers the raw material, and finally completes its record by carrying finished articles to the point of delivery.

Immense excavations such as those now in progress in Detroit have come exclusively to be a function of 5-ton dump trucks. Horse and cart have been eliminated as too hopelessly slow.

There is virtually not a single item of manufactured product that in some stage of its transit from the point of fabrication to the place of final application or consumption, does not depend on the highways and motor trucks for rapid movement. To attempt to present even a limited record of the services so rendered would be to extend this presentation unduly.

Other lines of activity not directly connected with production but intimately serving it, in which the truck has taken its dominating place, include:

Contractors, express, haulage and public utilities companies.

How All Interests Can Assist

If it be conceded that the highways may facilitate distribution and increase production, I should like to suggest to the gentlemen of this convention three main ways by which they may assist:

1st—We ask that you assist in allotting to railroads and motor trucks their proper kind of haulage, so that each unit may discharge its true function in transportation.

2nd—Your help is solicited to protect the motor truck against excessive taxation and unfair, ill-advised and restrictive legislation. Forty-five legislatures will meet next year. They will consider at least 3,200 motor vehicle bills. Business men should help law makers to realize that the motor vehicle is an economic asset, so that there may be enacted only laws which are fair and beneficial to highway transportation and the general public.

3rd—From a practical standpoint it is above all things vital that you aid us to establish an efficient system of highways under Federal direction.

Right roads must be available 365 days in the year; this involves a system of snow removal. During the war there were organized snow removals under state and national direction. This work could well be continued now, especially in keeping open that twenty per cent of roads on which ninety per cent of highway traffic is concentrated.

Limit Truck Weights on Highway

The automobile industry recognizes the menace to the highways of excessively heavy trucks and advocates that no vehicle weighing more than 28,000 pounds gross load, shall be permitted the use of the public roads as at present constructed. It believes also that the increasing use of pneumatic tires on trucks will reduce the damage.

But we are equally convinced that the highways of the future should be the servant of transportation not its master. They should be prepared to accommodate a constantly increasing volume of haulage carried by whatever size of truck shall prove most swift, efficient and economical.

Public interest is shown by the expenditures for hard-surfaced highways. According to estimates of the Bureau of Public Roads of the United States Department of Agriculture, these in 1919 set a new record with a total of $138,000,000. But this figure is small in comparison with the computed available total for 1920 of $623,000,000.

Need for National System of Highways

We must coordinate all this road building into a comprehensive system of highways under national control. The United States Chamber of Commerce in a resolution passed at St. Louis is already committed to such a program. We believe that our hopes in this direction will be best served in the passage of the Townsend Bill now before the Senate of the United States.

This bill calls for a national system of highways to be built and maintained by the Federal Government under the supervision of a Federal Highway Commission.

The Townsend Bill calls for an eventual expenditure of $425,000,000 to be spread over five years. To those who argue that our financial condition forbids such a comprehensive construction let us concede that economy is a right principle, but it should not be pressed to a point where it defeats investments necessary to prevent loss.

The high cost of living is no myth. Neither is the mud road. The prime reason for high costs is inability to deliver maximum production at prices permitting a profit to the farmer and a saving to the consumer. Waste due to unmiproved roads, is already estimated by figures developed in a Congressional investigation to reach the appalling sum of more than $500,000,000 per year.

Every man who believes in the facilitation of transportation as necessary to production and who concedes a place of importance to the motor truck in the general scheme of transportation becomes automatically a partisan of better roads.

Americans Hail the Pioneer

It is our American habit to hail the man who ventures. We immortalize the navigator who sails uncharted seas, the explorer who invades the fathomless forests.

We revere a Columbus, a Raleigh, a Perry. We cheer a Hawker, a Read or an Alcock.

The Lewis-Clark expedition fighting its way to conquer the northwest for the infant republic is one of the glories of our national history. We apply to a railroader like James J. Hill the admiring title of "Empire Builder."

Let us stop not at praising these giants who have opened world opportunities. Let us, within our capacity, emulate them.

The American business man has a chance to be discoverer, pioneer and developer. Before him lie two and three quarter million miles of unexploited highways. Let him dare to be their Christopher Columbus.

Those rude roads cry out a need. Poorly built as many of them are, they express man's need of contact with man. They lead from the palaces of the mighty to the huts of the lowly. They touch alike huge plants where thousands toil and the tiny farm where labors but one producer. They offer in peaceful conquest an El Dorado to make a Pizarro or a Cortez envy.

No discoverer, no invention, no creation of human gen-

ius offers such possibilities to mankind as one that facilitates transportation. When Robert Fulton launched the Clermont on the Hudson he little dreamed that he had discovered those new worlds for which Alexander sighed in vain that he might conquer them.

When Stevenson gave to mankind the locomotive, he foresaw not that he had founded an era of conquest to make the empire of a Napoleon seem negligible.

May we not have in the motor truck the discovery of world import? We ask your aid that we may develop it.

You gentlemen who want a wealthier, better, happier country can do no better than to center your attention on transportation.

We offer you here today the formula of harmony.

Harmonizing the Trinity of Transportation

A revived and protected merchant marine shall carry our international, coastwise and inland waterway trade. A railway system fairly dealt with by legislation and permitted to charge properly remunerative freight rates, shall girdle the country for bulk distance haulage. The highways through the motor vehicle, shall spread the benefits of an infinitely developed local service.

By the union of the three in efficient cooperation, sections may be joined, production speeded, taxation reduced, the costs of the war more speedily paid and the product of our country spread at lowered costs.

To achieve this practical program in the interests of all our people involves more than material considerations. It carries a lofty service to that true democracy whose protection, perpetuation and extension should be the highest aim of intelligent citizenship.

Effect of Oils on Strength of Glues in Plywood

Plywood may be used near machinery and tanks with little liklihood of being dangerously weakened by the action of oil or gasoline on the glue joints. This fact is evident from a test lately completed at the Forest Products Laboratory.

Plywood panels glued with animal. vegetable, blood albumin and casein glues were immersed for nearly a year in engine oil and gasoline. At regular intervals specimens were removed from the liquids and tested for joint strength. All the glues weakened somewhat during the early part of the test. the animal and vegetable glues more than the casein and blood albumin glues. The total loss of strength in any case however was small enough to be negligible under most conditions of service. A glue shear strength of 100 to 125 pounds per square inch is considered sufficient for practically any purpose for which plywood is used. Only in two or three instances did the strength of the casein and blood albumin glues fall below 150 pounds per square inch. Engine oil, castor oil and gasoline seemed to have practically the same effect on the glue joints.

During the 45 weeks' test the wood absorbed 60 per cent of its original weight in engine oil and 70 per cent of its original weight in gasoline. The absorption of these oils did not cause any noticeable swelling of the wood.

Comparison of Timber From Live and Dead Trees

Prejudice exists in certain quarters against the use of timber cut from dead trees and some purchase specifications insist that only timber cut from live trees will be acceptable. As a matter of fact when sound dead trees are sawed into lumber and the weathered or charred outside is cut away, there is no method known to the Forest Products Laboratory by which the lumber can be distinguished from that cut from live trees, except that the lumber from dead trees may be partly seasoned when sawed.

All the information available at the laboratory indicates that timber cut from insect or fire killed trees is just as good for any structural purpose as that cut from live trees of similar quality, providing the wood has not been subsequently injured by decay or further insect attack. If a tree stands on the stump too long after it is killed the sapwood is likely to become decayed or badly infested by wood-boring insects; and in time the heartwood also will be similarly affected. The same thing is true of logs cut from live trees and not properly cared for. Until the wood becomes affected by these destructive agents, dead tree wood should be just as strong and just as durable as sound live tree wood.

In considering the subject it may be useful to remember that the heartwood of a living tree is entirely dead, and in the sapwood only a comparatively few cells are living. Most of the wood cut from trees is dead, therefore regardless of whether the tree itself is living or not. Such being the case, purchase specifications instead of providing that material must not be from dead trees. should state that material showing evidence of decay or insect infestation exceeding a specified limit will not be accepted.

Cracking of Paint and Varnish

No subject exceeds in importance this one. Paint and varnish fissures are surface disturbances against which the reputable painter is constantly waging a vigorous warfare. The natural destiny of varnish, and of the finish in general, is to fissure and crack. It does this eventually by virtue of age, loss of vitality, action of the elements, and the reducing forces of service. The aim of the painter is to prolong the fatal day of collapes to the extreme limit of wear What he regards as the calamity, above all others, to be guarded against is the premature cracking and breaking apart of the finish. There are many cases for this early perishing and breaking up of the finish, among which may be mentioned inferior material, a poor quality of varnish, mixing of two or more makes or grades of varnish, using one make of rubbing-varnish and over it another make of finishing varnish, also unseasoned wood, imperfectly dried coats of surfacer, paint or color, or colors containing a lack of, or an excess of, binding material.

Recently, W. C. Teagle, president Standard Oil Co. of N. J., went on record with the statement that the country used 436,000,000 bbls. of oil in 1919, and would require not less than 650,000,000 bbls. in 1925. As he stated, new uses are constantly being found for petroleum products, and these in turn call for more and more petroleum. Mexico is estimated to have exported to this country 70,000,000 bbls. last year.

The country used 64,000,000 lbs. of wool in December, 1919, or 26,000,000 lbs. more than in December 1918.

What Trade-Marks Are and How Obtained

Great Importance of Trade-Mark to Manufacturer Reaching Out for World Wide Business

Concluded from Page 21, June issue

THE right to protection in the use of a common law trade-mark is not limited and may continue until affirmatively terminated in some manner, as for example, the abandonment of the trade-mark; or the discontinuance of the business and the passing away of the good will associated with it; or as the right may be modified or lost by laches; misrepresentation and fraud, or loss of distinctiveness.

An actual intention to permanently give up the use of a mark is necessary to constitute abandonment of it. Mere non-use, even for a considerable time, is not necessarily an abandonment, but long-continued disuse coupled with circumstances showing an intent to permanently give it up, will constitute abandonment.

The burden of proving abandonment is upon the party alleging it and it must be strictly proved.

Laches, or delay in bringing action against infringers, may be a bar to an accounting for profits and a recoverp of damages for past infringment, but is no bar to an injunction to prevent future acts where the legal right is clear.

Acquienscence in an infringing use of a mark by a competitor, although with knowledge of the infringing act, does not amount to consent, and is no bar to relief against a continuance of the infringement, although it may operate as a bar to the recovery of damages and an accounting for profits.

Material misrepresentation on the part of trade-mark user amounting to a fraud, may deprive him of the right to a remedy for infringement of his mark, or for any other form of unfair competition in business.

It has been so held in cases where there have been misrepresentations as to the business, goods, or their ingredients in advertisements or labels, but where such statements have been discontinued prior to the commencement of suit their former publication is not necessarily a bar to relief.

Mere trade puffing or boastful or extravagant statements; immaterial or slight inaccuracies, not substantially deceptive when fairly considered; or innocent misrepresentations made without intent to deceive, are not a bar to relief.

The exclusive right to a trade-mark may be lost if such mark for any reason loses its distinctiveness so that it no longer indicates a particular origin or ownership. The test whether or not this is the case is whether the use of it by other persons is still calculated to deceive the public.

Extensive, long continued, and indiscriminate use by a number of different persons will result in a loss of distinctiveness and cause the loss of the exclusive right to a mark.

Permitting a limited use by another, or scattering infringements by a number of persons, and even extensive piracy by a single individual, have been held not to have this effect.

Actions for Infringements and Unfair Competition

The appropriate courts of the different States have jurisdiction of such actions, even in the case of a trade-mark registered under the federal statute, the ordinary rules as to parties and practice being fully applicable.

The United States circuit courts have jurisdiction of suits for infringement of trade-marks registered under the federal statute without regard to the amount in controversy, or the citizenship of the parties. Where the trade-mark has not been registered under the federal statute they also have jurisdiction in cases where there is a diversity of citizenship of the parties, and where the amount or value of the matter in controversy exceeds the sum of two thousand dollars exclusive of interests and costs.

Federal district courts have no jurisdiction of suits for infringement of trade-marks.

In cases of trade-mark infringement and unfair competition, the courts acting on the equity side will grant injunctions where the legal right is clear, and where the plaintiff prevails and the Court believes that he is entitled to a substantial recovery damages will be awarded and an accounting as to the defendant's profits will be ordered.

Suggestions for the Selection of Trade-Marks

Before we proceed to the subject of registration of trade-marks, and believing that a few suggestions upon this point may be appreciated, we offer the following ideas:

First: It will be obvious that the most desirable and effective marks are those that are (a) simple in design; (b) easy to understand and remember; (c) attractive in appearance; and, (d) if the mark is an arbitrary word, easy to speak, spell and attractive in sound.

Second: It must always be remembered that marks that are descriptive or relate to the character or quality of the goods, or that are descriptive of the container or package, as well as geographical names, except when the latter are used in a fanciful or arbitrary sense, are unregisterable.

The misspelling of an unregistered word, or its arrangement in a fanciful design, does not relieve it from objection if it conveys information of a descriptive character.

A trade-mark will not be registered if it resembles a known mark already in use by another for goods of the same descriptive qualities, or so closely resembles such a mark as to be likely to cause confusion. Deceptive or misleading marks are unregisterable.

A trade-mark cannot be merely a color, a shape, a package or a container, and descriptive words and terms taken from a foreign language are unregisterable.

Third: The following are types of trade-marks that are proper subjects for registration.

Arbitrary numbers, letters or symbols, or a combination thereof with a word or words, when not descriptive, or trade terms relating to the articles with which they are used

Personal names are registerable when they are written, printed or stamped in such a way that the peculiarities of the writing, printing or design constitute the most particular feature of the mark. Autographic signatures, either with or without a portrait of the individual are registerable if so individualized. Names of historical persons or mythological characters may be registered, but the name of a living person cannot be used without consent.

Fourth. Lastly, a trade-mark is not registerable if its registration would be against public policy, or if its subject matter is scandalous or immoral, or if it is applied to articles harmful in themselves.

The New and Unusual in the Automotive Field

Red Devil Punches and Chisels in New Handy Form, New Westinghouse Ignition Outfit Is Non-Automatic, Howe Lightweight Spotlight

It will be the policy of Automotive Manufacturer (as in Automotive Engineering) to present on these pages each month some car, truck, aeroplane, boat, tractor, engine or other unit which presents unusual and decidedly different engineering features

Red Devil Pin Punch, and Chisel and Punch Set

These are handy and useful kits for motorists and machinists. In almost any kind of repair work, these tools will be in constant demand. For example, removing valves and piston rings in cylinders, cotter pins in crankshafts, relining brakes, replacing and repairing fan belts.

Every tool made of octagon stock, Swedish analysis point 80 carbon steel. The tools are put up in neat khaki cases that can be rolled up and put in the coat pocket or in the side door of the car.

Red Devil No. 169, Fig. 1, is the chisel and punch set. The tools are 5 inches long and come in a neat kit with the following tools: 2 cold chisels, 2 cape chisels, 2 machinists pin punches, 2 solid punches, 1 half round cape chisel, 1 round nose chisel, 1 diamond point chisel and 1 center punch.

Fig. 1. Red Devil 169 chisel and punch set.

Fig. 2. 483 set of punches

Red Devil No. 483, Fig. 2, is the pin punch set. Each tool is 9 inches long. The set consists of 6 tools in a khaki case. The sizes of points are: ⅛ in.; 3/32 in.; 3/16 in.; 7/32 in.; ¼ in.; and 9/32 in.

These kits are manufactured by the Smith & Heminway Co., Inc., Irvington, N. J.

New Westinghouse Non-Automatic Ignition

The new Westinghouse Type SC ignition, which made its first appearance on some of the leading makes of 1920 cars, embodies a number of interesting improvements in design and construction, including an indestructible condenser, a self-lubricating cam, a highly efficient coil, and breaker contacts that rarely require adjustment and should never need renewal.

This ignition, which is of the non-automatic, open-circuit, two-unit type, is suitable for use with 6 and 12-volt batteries, and for 4, 6 and 8 cylinder explosion gas engines for all automotive and stationary services. It can be supplied for either generator or engine drive, and a magneto replacement can also be furnished.

The distributor head, Fig. 3, consists of a base or cup, which holds the condenser and breaker-mechanism, and a cap, Fig. 4, which carries the high tension contacts.

The base is made of cast iron and is covered inside and out with baked-on enamel. It is provided with ventilating openings, which permit the escape of the nitrous oxide formed by the spark at the breaker contacts, and thus prevents corrosion of the metal parts.

The breaker mechanism consists of two arms; one of which is moved by the cam and the other is stationary. Each arm carries a contact. The movable arm is of special shape, and when operated by the cam, causes the contacts to open and close with a wiping action which keeps the surface clean and free from pitting. The stationary contact is held in place by a screw which, when loosened, permits adjustment in three directions and makes alignment with the movable contact a simple matter. The contact points are of pure tungsten and are securely riveted to the arms.

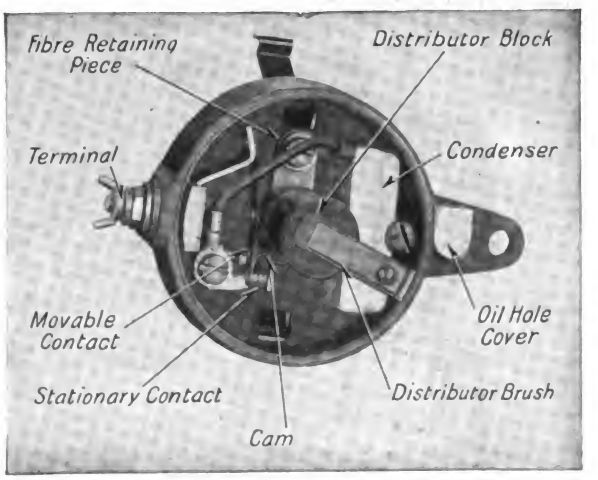

Fig. 3. General appearance of distributor of new Westinghouse ignition

Owing to the well-balanced design of the outfit and the effectiveness of the condenser, there is but little sparking at the contacts. This together with their extremely durable character and the continuous cleaning of the surfaces, makes adjustments rarely necessary under 10,000 miles, and renewals should never be needed.

The cam is of special interest. This part in most ignition systems is of fibre, steel or some some other metal, and as there is little opportunity for lubrication, unsatisfactory operation is apt to result due to wear. The Westinghouse Co. therefore resolved to prepare a material suitable for cams that would not require lubrication, and after a long series of experiments has produced a compound of graphite mixed with bakelite which is moulded under heat and high pressure. This material has proved to be very satisfactory and cams made of it have oper-

ated thousands of miles on car tests and many hours at high speed on bench tests without showing appreciable wear.

The condenser is encased in a tinned steel box with a close fitting cover wiped-soldered to the box; and the lead wire is heavily insulated at the point where it leaves the box. As the result of this construction the condenser is thoroughly protected from dust, moisture and mechanical injury.

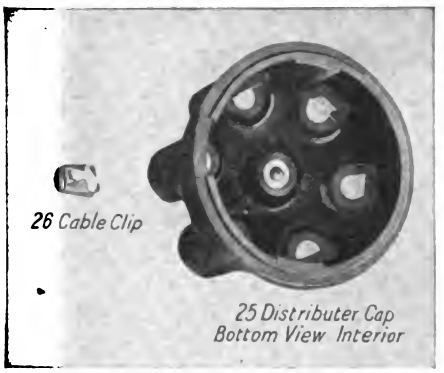

Fig. 4. The distributor cap removed to show interior

The distributor arm is mounted on a bakelite block which is carried on the top of the distributor shaft.

Inspection and renewals. As shown by the illustrations Figs. 5 and 3, removal of the distributor cap exposes all parts for inspection. Each part, including the shaft, can be removed on taking out a single screw. The screws are standard stock and can be obtained at any hardware store.

All parts except the cam and the distributor cap are the same for 4, 6 and 8 cylinder outfits.

The distributor cap has embedded in it as many brass thimble-shaped inserts as there are engine cylinders to be supplied with sparks, plus one center one which is connected with the coil. The bakelite compound is forced around these inserts into the shape of high necks above the top of the cap, so that the cap is one solid piece and has no joints at the bottom of the necks to admit moisture and cause grounds which may happen when the necks are screwed on. The top of the cap is crowned to shed moisture and a drip mould is provided around the base for the same purpose.

Fig. 5. General view of distributor assembled as used

The center contact is a graphite ball spun into a recess in its metal insert. A steel brush on the distributor arm presses continuously against this contact, the spark jumping from the end of the distributor arm to the engines-cylinder inserts in the proper order. Special attention is given to dimentional accuracy so as to insure uniform cylinder sparks.

The clips by means of which the high tension cables are connected to the distributor terminals, are of ingenious design and can be applied quickly without solder. They make an excellent mechanical and electrical connection, and can be removed and used again without difficulty.

The coil, Fig. 6, has highly insulated balanced windings which are encased in a micarta tube, with an insulating compound of high melting point poured in to exclude moisture. The mounting base is of steel and the cap is of a special vitreous porcelain baked in insulating enamel. Both cap and base are put on and set up tight by means of a through bolt when the compound is still hot.

The ballast coil is mounted in a groove around the cap and is made of a specially durable metal.

For very high grade cars where appearance is of importance, this ignition is furnished in a de luxe type. The distributor base casting is made of magnalium and the various parts are copper and nickel plated and hand buffed. Two-spark (dual spark) equipments are furnished in this type.

Fig. 6. View of Westinghouse Coil showing its enclosure

Howe Light Type Spotlight

The demand for a spot lamp of the lighter type which would possess the same degree of beauty as the heavier double-shell models has led to the addition of an exceptionally striking single shell model to the line of the Howe Lamp & Manufacturing Co., Chicago. The trade name of the new model is the No. 17 Howe Spot Lamp.

Like other Howe models No. 17 has the Howe flexible control, a feature which is patented and is therefore exclusive to the Howe line of spot lamps. The construction of the patented swivel-joints is such that they always remain flexible. The lamp is always easily movable yet holds firmly in any position in which it may be placed unaffected by the vibration of the car when driving on uneven pavements or rough roads. The spring tension of the swivel joints automatically overcomes the effect of wear and also eliminates the danger of "stiffness" which might otherwise result from exposure to rain and weather.

Fig. 7. Appearance of the light Howe lamp and its mounting

The No. 17 lamp is made entirely of brass with the exception of the bracket and clamp. Its large convex lens, its brilliant nickel trimmings and its richly enameled body all combine to produce an effect decidedly pleasing to the eye. The parabolic reflector, the conduit cable and other fittings are finished in triple nickel plate. The focusing device permits the concentration of the light into a long,

piercing ray for spotting objects far distant. Wires are protected by a waterproof conduit. The turn button switch is also of waterproof construction. The 4-inch rear view mirror is optional.

Possibilities in Automatic Welding Machines

(Continued from Page 9)

tinuous spiral deposition of metal. The speed of these various motions was adjusted by the gearing and the relative values of speed were based on previous experience with these equipments.

Referring to the comparative speed of operation of this machine and a hand welder on 1/16 in. metal where a hand welder is doing well to weld at the rate of 20 ft. an hour, this equipment has been able to weld up to 36 inches per minute. On heavy depositions such as the shaft referred to above, it is possible to deposit metal at the rate of 4 to 6 lbs. per hour. By hand the average deposition is, under favorable conditions, from 1.5 to 2 lbs.

Referring to the specific case of the comparative cost of a long shaft of uniform diameter having a single short enlarged diameter near the middle, formed by this machine for stock of the smaller diameter with the enlarged diameter deposited on, as against machining the whole thing from a bar slightly larger than the larger diameter, an estimate can be made on the cost of depositing the metal by assuming a deposition of 4 lb. per hour with an energy consumption of 14 kw hours, and 5 lbs. of metal. These figures, together with the welder's time will give the cost of depositing the metal from which can be estimated the cost of building up the shaft.

The principal field for this device is where a considerable amount of welding is required, the operations being a continuous repetition of duplicate welds. Under these conditions one can economically provide jigs and fixtures for facilitating the handling of the work and the clamping. Thus can be reaped the benefit of the increased speed in the actual welding which would be lost if each individual piece had to be clamped and handled seperately.

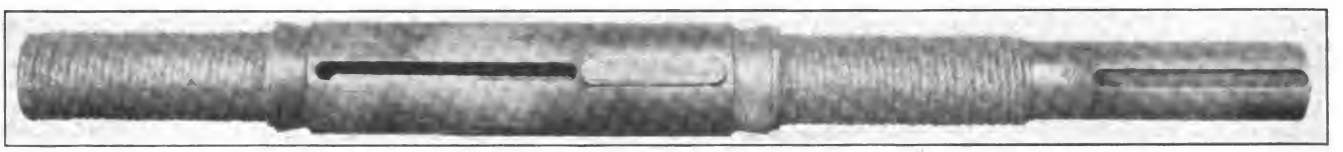

Fig. 7—Automobile Radiator Cover. Metal .044 in. thick, current 55 amperes, arc voltage 11, travel 17 feet per minute, electrode 1/16 diameter

Motor Truck Body Design Important

Motor truck utility depends much upon body design. A body unsuited for the work which it must perform causes loading and unloading delays that sometime result in unprofitable operation. Therefore it is just as important for the motor truck purchaser to give as close heed to body equipment as he does to the truck he selects.

Seven types of bodies serve most of the uses to which a motor truck is put. These are: (1) platform with or without stakes or stake gates; (2) box bodies for castings, bricks, etc.. (3) express bodies covered and with slatted or screened sides; (4) rack bodies for light bulky material; (5) van bodies for perishable groceries, furniture, pasteboard box goods, etc.; (6) dump bodies or elevating bodies for contracting work or coal delivery; (7) tank bodies for gasoline, milk, road oiling and flushing fuel oil.

Special types of work require special types of bodies. Granite or marble dealers and heavy machinery haulers, for instance; use a low-hung platform body; telephone companies use bodies especially constructed to accommodate tools, wire and equipment. Winches usually are mounted on these bodies. Barrel makers use bodies which enable them to pile barrels high and even on top of the cab. Some inter-city or rural motor express trucks are equipped with huge van bodies with enclosed cabs for driver protection. One big furniture dealer has had marked success with interchangeable van bodies, a preloaded body being swung quickly onto the chassis in place of the empty one.

Some types of bodies are intended to accommodate so heavy and huge a bulk that the semi-trailer style of construction is used to distribute the weight more evenly.

Progressive manufacturers have made a thorough study of the body question and prospective truck owners would be wise to avail themselves of this information.

Civil Service Opening for Automobile Mechanic

The United States Civil Service Commission announces an open competitive examination for auto mechanic. A vacancy in the office of the Chief Clerk, Treasury Department, Washington, D. C., at $1,200 a year, and vacancies in positions requiring similar qualifications, at this or higher or lower salaries, will be filled from this examination, unless it is found in the interest of the service to fill any vacancy by reinstatement, transfer or promotion.

Appointees whose services are satisfactory may be allowed the temporary increase granted by Congress of $20 a month.

All citizens of the United States who meet the requirements, both men and women, may enter this examination; appointing officers however have the legal right to specify the sex desired in requesting certification of eligibles.

Competitors will not be required to report for examination at any place but will be rated on the following subjects, which will have the relative weights indicated on a scale of 100. (1) Physical ability, 40; (2) training and experience, 60. Under the second subject competitors will be rated upon the sworn statement in their applications and upon corroborative evidence.

Applicants must show that they have had at least one year's experience repairing or overhauling automobiles in a repair shop or factory. Experience in driving automobiles is also desirable.

Applicants must have reached their eighteenth birthday on the date of the examination. Applicants should obtain Form 1,800.

In 1917 Canada exported $4,604,899 worth of motor cars, and in 1918, $3,807,278 worth. The largest customer in both years was Australia, with $1,473,226 in 1917, and $1,326,443 in 1918.

Combination Fuel, One-Third Gasoline Found

Following apparently satisfactory test block studies of a synthetic airplane engine fuel known commercially as Alcogas and composed of 38 parts alcohol, 19 parts benzol, 4 parts toluol, 30 parts gasoline and 7½ parts ether, the Post Office Department arranged for a test of the fuel under service conditions in the air mail.

Mail plane No. 35, a Curtiss Model R4 machine equipped with a high compression Liberty 12 engine, was assigned for the work, the check plane, flying the opposite trips during the same period with high test aviation gasoline, being mail plane No. 34, also a Curtiss Model R34 plane, equipped with a low compression Liberty 12 engine.

The following carburetor settings were used:

	Alcohol Fuel High Compression Liberty	Gasoline Low Compression Liberty
Choke	31	31
Main Jet	145	145
Compensator	170	165
Well	100	100

Thirty-one trips were flown between New York and Washington, being 218 mi. non-stop flights, on the regular air mail schedule between Aug. 4 and Sept. 19, 1919. The flights made by the gasoline ship numbered nineteen. The test was conducted under the direction of J. C. Edgerton, Chief of Flying and testing, air mail service.

The tests indicate a saving of 3.3 gal. of fuel an hour in favor of the alcohol fuel. Noting the revolutions per minute however, the saving is even greater, as alcohol fuel shows 1514.3 r.p.m. as against 1507.8 r.p.m. with gasoline. This means that not only is there a saving of 3.3 gal. of fuel per hour, but that 6.5 r.p.m. are gained also by the use of the alcohol fuel.

Alcohol fuel also shows a saving in lubricating oil. The average for this fuel was 4.4 quarts per hr. as against 4.98 quarts per hr. for gasoline, or a net saving of .58 quarts per hr. This oil saving is thought to be due to greater thermal efficiency displayed by alcohol fuel as against gasoline. This does not appear on the face of the charts, due to the fact that high compression engines usually run considerably warmer than do low compression engines. As the average on both tables show 167 deg., it is thus apparent that the alcohol fuel shows a relatively lower temperature.

The following is the report of the field manager on the condition of the engine in plane 35 after the alcogas tests:

Carbon deposit was found to be from 1-32 to 1-16 in. thick, soft and flakey. Carbon was thickest on outside of piston crown showing it to be caused from oil rather than incomplete combustion of fuel. Valves were all in good shape. Valve seats showed no signs of pitting or warping No. 6 connecting rod babbitt bearing cracked in both cap and rod. Two piston rings were broken and six stuck in grooves. Motor in very good shape considering number of hours run."

The high compression engine used in plane No. 35 during all of its flights on alcohol fuel was torn down after approximately 125 hr. and was found to be in excellent condition. The carbon deposited was less than that found in a motor using gasoline over a similar period of time.

An analysis of the consumption of the alcohol fuel with various revolution speeds is as follows:

1440 to 1460	r.p.m.	15.9 gal.p.hr.
1475 to 1480	"	20.1 "
1500	"	21.5 "
1520 to 1525	"	22.44 "

There follows comparative analysis of fuel consumption on gasoline and alcohol fuel at different engine speeds:

Revolutions per minute	1440-1460	1475	1500
Gasoline		24.0	24.17
Alcohol fuel	15.9	20.1	21.5

There follows a comparative analysis of oil consumption at different engine speeds:

Revolutions per minute	1440-1460	1475	1500
Gasoline		4.65	4.95
Alcohol fuel	4.5	4.2	4.2

As this fuel contains but 30 per cent. of gasoline, and none of the other components are derived from petroelum, the universal use of this fuel for cars, trucks and other automotive units, would multiply the quantity of motor fuel available by 3 1/3, or give the same effect as more than tripling present oil production.

Inflammability of Gasoline

There are two methods for determining the content of gasoline vapor in air, according to G. A. Burrell, in Technical Paper 115, Bureau of Mines publications. One has to do with the introduction of the mixture into an exhausted glass vessel, cooling it at the temperature of liquid air, removal of the air, and finally the measurement of the partial pressure of the gasoline vapor by means of a manometer attached to the liquefaction bulb.

Another method consists in burning the gasoline vapor in oxygen and, from the contraction and carbon dioxide produced, calculating the percentage of gasoline vapor.

When a 100 c.c. Hempel explosion pipette was used and the mixtures were ignited from the top, there was obtained as the lower limit of complete inflammation a value lying between 1.9 and 2 per cent of gasoline vapor. The upper limit under these conditions was found to be between 5.2 and 5.3 per cent of gasoline vapor. The gasoline used had a specific gravity of 73 deg. B. Under the same conditions, except that the mixtures were ignited from the bottom, there was obtained a value lying between 1.5 and 1.6 per cent of gasoline vapor as the low limit. With the same grade of gasoline, with a 2,800 c.c. vessel, and with ignition from the bottom by means of an electric flash produced by pulling apart two wires through which a current of 7 amperes at 220 volts was flowing, there was obtained a value lying between 1.4 and 1.5 per cent of gasoline vapor. The high limit under these conditions lay between 6 and 6.4 per cent of gasoline vapor.

When the initial temperature is increased before ignition of the mixtures the low limit is gradually decreased until with an initial temperature of 400 deg. C. the low limit lies between 1.02 and 1.22 per cent of gasoline vapor.

The range of complete combustion for mixtures of gasoline vapor and air is very narrow, and is between about 1.5 and 2.5 per cent. The amount of carbon dioxide produced reaches a maximum at 2.5 per cent of gasoline vapor. At this point, as the percentage of gasoline vapor increases, carbon monoxide begins to form. At 4.1 per cent of gasoline vapor there is produced 14 per cent of carbon monoxide.

Men of the Automotive Industry

Who They Are What They Are What They Are Doing

Benjamin S. Pfeiffer joins the Page Co., consulting engineers of Chicago, June 1. Pfeiffer's experience dates from the early days of the tractor industry when he assisted in designing one of the first self-lift plows for the Avery Co. He was also associated with the Holt Mfg. Co., the International Harvester Co., and the New Departure Mfg. Co.

N. S. Reed, formerly truck engineer of the Paige-Detroit Motor Car Co., has joined the organization of the Hinkley Motors Corp. as consulting engineer in the sales division. Mr. Reed will work toward the adaptation of heavy-duty automotive engines to trucks, and his long experience will be of distinct advantage to truck manufacturers.

Adolph A. Geisel, who has been Eastern district manager and special representative for the Federal Motor Truck Co. since 1912, has disclosed his intentions of manufacturing a truck to be built of standard units and which will be known as the Facto. Geisel has purchased 55,000 square feet of land in Springfield, Mass.

P. C. Wagner has been appointed chief engineer of the Four-Drive Tractor Co., Big Rapids, Mich. Mr. Wagner was formerly with Blood Bros. Mfg. Co., and prior to that with the Motor Products Corp. He will have complete charge of the designing, drafting and other engineering work in the Four-Drive plant.

E. F. Roberts has been made vice president in charge of manufacturing, of the Packard Motor Car Co., Detroit, Mich., succeeding F. F. Beall, who recently resigned to head the Gray Motor Co. Roberts began his career with the Packard organization as a mechanic when that company was located at Warren, O.

R. J. Shuler and J. E. Ryan, whose training as purchasing agents for well-known parts manufacturers has brought them a thorough knowledge of sources of supply, have poined forces in a company whose name indicates its purpose, the International Purchasing & Engineering Co., Penobscot building, Detroit.

N. S. Reed, formerly truck engineer of the Paige-Detroit Motor Car Co., has joined the Hinkley Motors Corp., Detroit, Mich., in the capacity of consulting engineer of the sales division. Reed has also had prior truck experience with Gramm, Garford, and with the United States Government.

E. J. Miles has succeeded to the title of chief engineer of the Maxwell and Chalmers Motor companies, following the resignation of William Kelly, several weeks ago. Miles has been with the Maxwell-Chalmers enterprise for a number of years and heretofore has borne the title of engineer.

R. W. Gallagher severs his connection with the East Ohio Gas Co., Cleveland, June 1, to become acting president of the Motor Castings Co., Canton. This company, which was taken over some time ago by a company organized by Mr. Gallagher, manufactures motors for trucks and tractors.

Harold T. Moore, recently of the A. E. F., where he served with the motor repair corps in the field, has been made production manager of the Tuthill Spring Co., Chicago, Ill. Another recent appointment to the factory staff is George Boehm, who becomes factory superintendent.

H. H. Newsom has been made president of the Clay Engine Mfg. Co., Cleveland, O. Newsom was formerly acting general manager of the Standard Welding plant, Standard Parts Co. Prior to that he held the position of director of purchasing for the whole Standard Parts group.

S. R. Thomas is now assistant engineer of the Jordan Motor Car Co., East Cleveland, Ohio. He was previously connected with the engineering department of the Central Division of the General Motors Corporation and the Hudson Motor Car Co., both of Detroit, Mich.

K. D. Smith has been appointed factory superintendent of the Syracuse Rubber Co., Syracuse, N. Y. From 1909 to 1915, Smith has had much experience in various tire plants, and was employed by the Miller Rubber Co. until he joined the Syra-Cord forces last November.

John Younger, vice president of the Standard Parts Co., Cleveland, has received a citation for exceptionally meritorious and distinguished service as advisory engineer in the designing and production of the standard motor vehicles adopted by the United States.

Walter E. McKechnie, who was associated with the Cadillac Motor Car Co., Detroit, Mich., for 12 years as electrical and factory engineer, has accepted the position of factory engineer with the American Electrical Heater Co., also of that city.

Walter P. Chrysler has been apopinted general manager of the Willys-Overland Co., Toledo, Ohio. He was formerly president of the Buick Motor Car Co., Flint, Mich., and vice president in charge of production of the General Motors Corporation.

W. F. McLaughlin, general superintendent of the Hyatt Bearings Division, General Motors Corp., has recently resigned. McLaughlin joins the Ace Motor Corp., Philadelphia, Pa., with which he will act in the capacity of works manager.

George W. Mixter has been elected president of the Pierce-Arrow Motor Car Co., Buffalo, N. Y., succeeding John C. Jay, Jr., who has been elected chairman of the executive committee. Col. Clifton has been reelected chairman of the board.

C. F. Taylor has accepted a position in the engineering department of the H. H. Franklin Mfg. Co., Syracuse, N. Y. He was formerly assistant engineer in the powerplants laboratory of the Air Service at McCook Field, Dayton, Ohio.

E. B. Horne, manager of the forge and foundry divisions of the Packard Motor Car Co., has resigned after 12 years' connection with the company. He will devote his time to the Rochester Foundry & Machine Co., Rochester, Mich.

L. F. Fedders has been elected president of the Fedders Mfg. Co., Buffalo, N. Y., manufacturer of automotive radiators. C. W. and J. M. Fedders are vice presidents; T. C. Fedders, 2nd, treasurer; and H. L. Heitzman, secretary.

G. A. Ungar has been appointed general sales agent and consulting engineer of the Flexite division, Slocum, Avram & Slocum Laboratories, Inc., Newark, N. J. In order to devote himself entirely to the commercial development of Flexite universal joints and propeller snafts which he designed, he severed his connections about a year ago with the S K F Industries, where he held the position of technical manager and chief engineer.

Frank S. Davis has become associated with the Lexington Motor Co., Connersville, Ind. Davis formerly held the position of chief engineer of the light and power engineering division, tractor works, International Harvestor Co.

Ray T. Middleton has been elected vice president and director of sales of the Kelly Metals Co. with headquarters at Chicago. He was formerly general representative of the Standard Steel Castings Co., Cleveland.

Everett Cavanagh has tendered his resignation as secretary-treasurer of the Bimel Spoke & Auto Wheel Co., Portland, Ind., his resignation to take effect June 1. Bimel's plans for the future are as yet undisclosed.

William H. Miller, who was formerly consulting engineer of the Flexible Armored Hose Corporation, Buffalo, has been appointed general manager and director of sales of the International Metal Hose Co., Cleveland.

S. V. Norton, long identified with sales of the B. F. Goodrich Rubber Co., Akron, O., has resigned, his resignation having gone into effect June 1. Norton has joined the General Motors Truck Co., Pontiac, Mich.

J. A. Tarkington has resigned as superintendent and consulting engineer of the Kissel Motor Car Co., Hartford, Wis., and is now vice president and factory manager of the Takrington Motor Car Co., Rockford, Ill.

R. M. Bean and A. C. Bryan, sales manager and factory manager repsectively of the Durston Gear Corporation, Syracuse, N. Y., were elected directors and vice presidents at a recent meeting of the stockholders.

H. G. Root, general manager of the Westcott Motor Car Co., has been chosen president of the Springfield, O., Employeers' Association. Mr. Root was president of the Springfield Chamber of Commerce last year.

Dr. Van H. Manning, director of the Bureau of Mines, Department of the Interior, has resigned to join the American Petroleum Institute as director of research. Manning's resignation becomes effective June 1.

H. H. Keeports, who was formerly assistant general manager of the Anderson Forge & Machine Co., Detroit, is now manager of the crankshaft division of the Canton Drop Forging & Mfg. Co., Canton, Ohio.

D. M. Roades, for years identified with the automotive industry, has recently been appointed sales manager of the Lack Mfg. Co., Paducah, Ky., manufacturers of the Multi-Disc Aluminum Wheels.

Louis Steinfurth, Jr., who was formerly with the Cleveland Automobile Co., Cleveland, has accepted a position in the engineering department of the Paragon Motor Car Co., Connellsville, Pa.

W. H. Vohrer, who served in the Motor Transport Corps with the rank of second lieutenant, has accepted a position in the ordnance engineering laboratory of the Holt Mfg. Co., Peoria, Ill.

Clarence B. Atkins has been appointed superintendent of the forge and machine shop of the New Departure Mfg. Co., Bristol, Conn. Edward Granger is assistant to Mr. Atkins.

O. E. Szekely has been appointed consulting engineer of the U. S. Tractor & Machinery Co., Menasha, Wis. Mr. Szekely will serve also in an advisory capacity to the manager.

C. G. Keller has been appointed chief engineer of the Bessemer Motor Truck Co., Grove City, Pa. He was formerly mechanical engineer with the Robeson Cutlery Co., Perry, N. Y.

R. H. Watson, formerly with the Detroit Iron & Steel Co. as superintendent, has joined the Ford organization as general superintendent of the blast furnaces at River Rouge.

R. J. Schuler has resigned as director of purchases for the Detroit Gear & Machine Co. to take the presidency of the International Purchasing & Engineering Co., Detroit.

Henry H. Knapp has been elected treasurer of the United States Light & Heat Corp. of Niagara Falls, N. Y. The company manufactures storage batteries.

F. C. Haeske has been made production engineer with the Parish & Bingham Corp., Cleveland, O. During the war Haeske was a lieutenant in the army.

M. M. Risberg, who was formerly comptroller of the Republic Motor Truck Co., Alma, Mich., is now connected with L. V. Estes, Inc., Chicago, Ill.

C. D. Gilpin, for eight years with the Aluminum Castings Co., has been made works manager of all Detroit plants of that concern.

H. A. Oswald, chief engineer of the Quaker City Corporation, Philadelphia, Pa., has returned from Cuba after a stay of 4 months.

J. S. Burdick, of the Buffalo Body Corporation, Buffalo, N. Y., has just been made general manager of that company.

W. H. Marsten has been appointed assistant general manager of the Oakland Motor Car Co., Pontiac, Mich.

Spencer Welton has resigned as president of the Sterling Tire Corporation, Rutherford, N. J.

Hugo Gibson has joined Root & Van Dervoort Engineering Co., Moline, Ill.

OBITUARY

Edwin C. McGraw, founder, and for ten years president of the McGraw Tire & Rubber Co., Cleveland and East Palestine, O., died at his home in the south, Miami, Fla., May 25.

Current Automotive Metal and Supply Prices

General Business Car shortage has become acute in many districts and has had an adverse influence on business. Appearances indicate the granting of an increase to the railway men of 60 per cent of their demands, not enough to satisfy them but sufficient to avoid any disturbance. This undoubtedly will have a tranquilizing effect. General reports indicate that labor is settling down to work with a more satisfied air and is showing greater efficiency. The huge sums needed to move the crops will be called for shortly and undoubtedly will unsettle the money market during August and September

Iron and Steel Car shortage has caused higher fuel prices as well as distress in making deliveries and getting raws. Steel and iron plants feeling this double adverse effect are lessening production. Quite a little capacity is idle in Pittsburgh. Basic valley is $2.50 a ton higher,, Bessemer $3 and malleable $1. All steel scrap is up in Pittsburgh for instance, heavy steel scrap is up $15 a ton. Bolt and nut discounts have been revised and are uniformly less by either a 5 or a 10.

Copper and Aluminum Domestic consumers are showing more interest while buying for export continues small but steady. The tone of the market continued strong but with no change in prices. Aluminum has increased slightly but large lots are available

Lead and Tin Lead shows little change although the prices have stiffened in the last week. Some quick shipment metal has been sold at 8.65 c N. Y., but the prevailing price is 8.40 c. Tin also shows little signs of life, a whole week's sales amounting to but 175 tons. There is no Straights in New York for spot delivery. Arrivals to July 13 totalled 1,630 tons with 5,430 tons afloat.

Zinc and Other Metals Zinc is strong and recent inquiries have moved the price upward slightly. Prime western stands at 8.20 c N. Y. for delivery in the third quarter. Wholesale lots of antimony are available at 7.50 to 7.70 c N. Y. duty paid. Silver is rising again, the outside market moving regardless of the Government pegged price. Ferromanganese is down

Chemicals Due to the fact that lessened production has not increased supplies while demand continues, prices have been maintained. Caustic potash and soda, and soda ash are all higher. Coal tar products have seen a flat 5 c rise recently.

Other Materials The rubber market is as badly disorganized as at any time in the last year. Prices are down very close to 30 c for the finest qualities, and this has resulted in the failure of one of the largest importing firms which bought most of its supply on hand at 55. The condition was brought about primarily by the dumping on the market of enormous quantities of war surplus from India. London cables indicate a firmer feeling there. Hides are inactive, buyers and sellers being too far apart. All transactions are in small lots, one of which included some Bogotas at 32 c. The prevailing quotation on this grade is 30 c.

Every effort is made to have the following prevailing prices (compared with last month's) accurate but none is guaranteed. They are obtained through trade sources and may not be realized on small quantities:

	June 8	July 14
Acid, Sulphuric, 66°.....ton	$23.00 —25.00	26.00 —28.00
Alcohol, Ethyl, 97 p.c.....gal.	6.00 — 7.00*	6.00 — 7.00*
Alcohol, denatured, 190 proof, gal.	1.00 — 1.05*	1.05 — 1.10*
Aluminum, Ingots No. 1 99% pure, carload lots.....lb.	.33	.35 — .38
Ammonium Chloride (Sal-Ammoniac) white, granular....lb.	.17 — .18*	.17 — .18*
Babbitt Metal, best grade.....lb.	.90	.90
Babbitt Metal, Commercial....lb.	.50	.50
Beeswax, natural crude, yellow.lb.	..	..
Carnauba No. 1 Wax.....lb.	.93 — .95 *	1.00 — 1.05*
Caustic Potash (85-92 p. c.)..lb.	.31 — .35	.35 — .38
Caustic Soda, 76 p. c.....100 lb.	6.25 — 6.50	6.50 — 7.50
Pumice, Ground (domestic)....lb.	.02½	.04 — .07
Shellac, Orange, superfine....lb.	1.60 — 1.65	1.50
Tin, Metallic straits pig.....lb.	.54	.51
Turpentine, spirits of crude....	2.27 — 2.30	1.75
Zinc, Western Spelter.....lb.	.10 — .11	.10 — .11
No. 9 base casks, open.....lb.	.15	.15

*Nominal

IRON AND STEEL, PIG, BARS, ALLOYS, OLD METAL

Pig, per ton—	June 8	July 13
No. 2 X, Philadelphia§.....	$47.15	$48.15
No. 2, Valley furnace†.....	45.00	45.00
Basic, delivered, eastern Pa.....	44.80	43.00
Basic, Valley furnace.....	43.50	46.00
Bessemer, Pittsburgh	44.40	47.40
Malleable, Valley	44.00	45.00
Refined iron bars, base price....	5.25	5.25c
Soft Steel—		
¾ to 1⅞ in., round and square..	3.52—5.25c	3.52—5.25c
1 to 6 in. x ⅜ to 1 in.....	3.52—5.25c	3.52—5.25c
1 to 6 in. x ¼ and 5/16.....	3.62—5.25c	3.62—5.25c
Rods—⅝ and 11/16.....	3.57—5.05c	3.57—5.05c
Bands—1½ to 6 x 3/16 to No. 8..	4.22—6.50c	4.22—6.50c
Ferromanganese, 76% to 80% delivered producers' price.....	$240.00—250.00	$200.00—225.00
Spiegel, 18% to 22% furnace, spot	70.00— 75.00	70.00— 75.00
Ferrosilicon, 50%, spot, delivered	80.00— 85.00	80.00— 85.00
Old Metal		
Heavy steel scrap, Pittsburgh...	25.00	40.00
Heavy steel scrap, Philadelphia..	22.50	37.00
No. 1 cast, Pittsburgh.....	32.00	40.00
No. 1 cast, Philadelphia.....	37.00	37.00

†Silicon, 1.75 to 2.25. §Silicon, 2.25 to 2.75.
Ferrosilicon prices at Ashland, Ky., Jackson and N. Straitsville, O.

BOLTS AND NUTS

(Discounts are from Nov. 1, 1919)	June 8	July 13
Machine bolts, c.p.c. and t. nuts, ⅝ x 4in.; Smaller and shorter..	35	30
Carriage bolts, ⅜ x 6 in.:		
Smaller and shorter, rolled threads	40— 5	30—10
Cut threads	30—10	30
Semi-finished hex. nuts:		
⅛ in. and larger.....	60— 5	50—10
9/16 in. and smaller.....	70— 5	50—10
Tire bolts	55—10	50

BRASS, COPPER SHEETS, SHAPES, VIRGIN METAL, SCRAP

	June 1	July 13
Copper, Lake, ingot.....lb.	$ 0.19¼	$0.19
Copper, Electrolytic .....lb.	.19	.19
Copper, Casting .....lb.	.19	.18½
Copper sheets, hot rolled.....lb.	.29½	.33½
Copper sheets, cold rolled.....lb.	—	—
High brass wire and sheets....lb.	.25½	.30¼
High brass rods.....lb.	.23¾	.25
Low brass wire and sheets....lb.	.27¼	.28½
Low brass rods.....lb.	.28	.29
Seamless bronze tubing.....lb.	—	—
Seamless brass tubing.....lb.	.30½	.33
Old Metal—		
Copper light and bottoms.....	.12¼—.12¾	.15
Brass, heavy	.07¼—.07¾	.13
Brass, light	.06¾—.07¼	.09
Heavy machine composition.....	.08 —.08¼	.17¾
No. 1 yellow brass turnings.....	.10 —.10½	.10½
No. 1 red brass or comp. turnings	.16 —.16½	.15

CRUDE RUBBER

	June 11	July 14
Para, Upriver fine.....lb.	$ 0.37½	$0.34¼—.35
Upriver coarse .....lb.	.28	.24 —.24½
Upriver caucho ball.....lb.	.30	.26 —.26½
Plantation, first latex crepe...lb.	.38	.32½—.33
Ribbed smoked sheets.....lb.	.38	.33 —.33½
Brown crepe, thin, clean....lb.	.37	.32 —.32½

PETROLEUM PRODUCTS

	June 11	July 20
Oil—Pennsylvania Crude	$ 6.10	$6.10
Kansas and Oklahoma Crude..	3.50	3.50
Gasoline, Motor, garages, steel bbls..	.30	.30
Consumers, steel bbls.....	.32	.32
Lubricating Oil, black, 29 gravity	.28—.35	.28—.33
Cyl. light filtered.....	.90—.95	.90—.95
Dark filtered	.83—.85	.83—.85

Activities of Automotive Manufacturers

Where They Are Located What They Are Doing How They Are Prospering

C. H. Wills & Co., Marysville, Mich., have elected the following officers: C. Harold Wills, president; John R. Lee, vice president; Kirkland B. Alexander, vice president; Charles Morgana, vice president; Frank P. Book, treasurer; Ferris D. Stone, secretary, and George S. Anderson, assistant secretary and assistant treasurer. Mr. Wills and Mr. Lee have been prominently mentioned in connection with the activities at Marysville since its inception. Mr. Alexander is of Power, Alexander, Jenkins & Co., advertising. Mr. Morgana was formerly associated with Mr. Wills and Mr. Lee at the Ford Motor Co. Mr. Book has extensive business and real estate interests in Detroit. Mr. Stone was formerly with the law firm of Miller, Smith, Paddock & Perry. Mr. Anderson was with the Ford Motor Co.

Marwin Motor Truck Co., Kenosha, Wis., manufacturer of quadruple drive commercial vehicles, has purchased 18 acres adjacent to the plant of the Winther Motor Truck Co., an inter-related corporation building rear-drive motor trucks. The two corporations are to be merged and the operations consolidated as soon as conditions are more favorable regarding new construction. The Kenosha Wheel & Axle Co., also affiliated with the same interests, and now occupying a plant at Winthrop Harbor, Ill., will then take over the present Marwin shops. Martin P. Winther is head of the three corporations.

Gardner Motor Co., St. Louis, will be incorporated on August 1, backed by local and eastern banking interests, to expand the business and make it one of the largest motor-production companies in the southwest, according to an announcement made by Russell E. Gardner, president. It is said that Hornblower & Weeks, New York, and L. E. Anderson & Co., St. Louis, have bought $1,500,000 of the new stock. The estimate of 1921 production is 15,000-18,000 cars.

American Motorcycle Co., Louisville, Ky., Otto Seelbach and others interested, have purchased for $30,000 a former Government building in Louisville, which will be equipped to manufacture motorcycles. The company is capitalized at $200,000.

Hamilton Motors Corp., Grand Haven, Mich., is taking bids for a one story addition, 60 x 130 ft., to cost about $75,000. It will be used by the Apex Truck Co., manufacturer of motor trucks, an affiliated organization.

Vim Motor Truck Co., Philadelphia, manufacturer of automobile trucks, is removing its present plant at Twenty-third and Market streets to the former gun works of the Midvale Steel & Ordnance Co., Wawne Junction, recently acquired. The Market street plant will be offered for rent. The company proposes a largely increased capacity. E. E. Smith is president.

Traffic Motor Truck Corporation, 5220 North Second Street, St. Louis, has awarded a contract to the Murch Brothers Construction Co., Railway Exchange Building, for a new one story plant, 150 x 150 ft. A portion of the structure will be used for the manufacture of gears for steering service, axles, etc. Guy Wilson is president.

Portsa Motors Co., Milwaukee, has been incorporated with a capital stock of $100,000 to engage in general automotive engineering and to manufacture motors, motor cars, parts, etc. The incorporators are John C. Meyer, Milton F. Thompson, 256 Thirteenth Street, and Reimer C. F. Kurtze, 713 Thirty-sixth Street, Milwaukee.

Pioneer Automobile Truck Co., of Chicago has closed a deal for a site in Valparaiso, Ind., and in a short time will let the contract for a building 100 x 300 ft. one story in height, of the monitor type. The company has leased temporary quarters for the building of its trucks until the new building is completed.

Jacquet Motor Car Co., Belding, Mich., a new concern which is about to bring out a high grade four-cylinder car, is variously reported to have purchased 28 acres of land in Belding for future expansions, and to be considering a move to Manitowoc, so as to be nearer the parts manufacturers of Milwaukee.

Packard Motor Car Co., Detroit, has arranged an expansion program calling for an appropriation of $16,000,000 for extensions and equipment. About $2,000,000 will be used for enlargements in the truck department. Certain departments of the pleasure car works will also be increased at an early date.

American La France Fire Engine Co., Elmira, N. Y., has awarded all miscellaneous contracts for the erection and completion of its new plant on North Arlington Avenue, Bloomfield, N. J., for the manufacture of motor trucks. The works will cost about $300,000, including equipment.

R .E. Swenson and others of Denver, Colo., have organized the Two-Way Tractor Plow Co., with a capital stock of $1,000,000.

Tractor & Mchy. Co. has been incorporated at New Bern, N. C., with a capital of $100,000 by A. F. Patterson, T. G. Hyman and J. B. Rice.

Menominee Motor Truck Co., Clintonville, Wis., will build a structure 100 x 150. Work on excavation will be started as soon as the weather permits. The company will have the immediate use of one of the F. W. D. warehouses for office purposes or for assembling.

Royer Tractor Co., Wichita, Kan., has been reorganized and incorporated under the name of Royer Tractor Mfg. Co. It has a capital stock of $1,000,000. The incorporators are: A. U. Skaer of Augusta, Kan., and J. A. Rowland and H. D. Mollohan of Wichita.

Oakland Motor Car Co., Pontiac, Mich., has authorized an addition to its engine plant which will cost about $3,000,000. The work is to be started at once in order to double capacity of the plant by the first of next year.

Sopwith Aeroplane Corp. of America, New York, has been incorporated with a capital stock of $50,000 by J. and A. McKittrick, and J. W. Bishop, 30 East Sixty-first Street, to manufacture airplanes and parts.

Huron Truck Co. has been incorporated at Bad Axe, Mich., by F. W. Kinde, W. R. Lyons, C. C. Henney and F. M. Cross. A factory has been secured and it is planned to produce fifty trucks this year.

Oldsmar Tractor Co., Oldsmar, Fla., is planning the erection of additional buildings to increase its capacity. The capital stock of the company recently was increased from $100,000 to $500,000.

United States Automobile & Tractor Co. has been incorporated at Lincoln, Kan., by H. D. Hall, Geo. Hundermark and J. J. McCurdy. The capitalization is $50,000.

Maccar Truck Co., Gilligan Street, Scranton, Pa., has completed plans for a one story building, 95 x 200 ft., to cost about $75,000, and another one story structure to cost $10,000.

Bedford Tractor Co. has incorporated at Bedford, Ind., with a capitalization of $200,000. The directors are Newton M. Anderson, J. Frank Walls and John R. Pearson.

Mutual Truck Co., Terre Haute, Ind., has increased capital to $5,000,000. A plant 400 x 750 is now under course of construction and will be built in units 150 x 200.

Acme Motor Truck Co., Cadillac, Mich., is enlarging its plant by building an addition in the center of the present group of buildings. The addition is 225 x 80 ft.

Liberty Vehicle Co., Natchez, Tenn., has been incorporated with $25,000 capital by L. K. Sharpe, S. Gelsenberger, J. N. Stone and others.

Partridge Tractor Co. has been incorporated at Jacksonville, Fla., with a capital of $100,000. W. L. Sharkey will be manager.

J. I. Case Plow Works Co., Racine, Wis., is erecting a four story brick and concrete building, 123 x 138, to cost $150,000.

B. F. Avery & Sons, Louisville, Ky., will erect a five story building, 127 x 260 and a two story building, 83 x 178.

Dort Motor Car Co., Flint, Mich., has filed plans for a two story machine shop on South Street, 40 x 170 ft.

Body Builders

Seaman Body Corp., Milwaukee, Wis., has ambitious plans for a very large output of bodies, and will soon give employment to 1,000 men. The company is building its new plant on Richards Street and estimates are made that it will be ready for occupancy around Sept. 1, when the men will be needed. Excellent progress is being made on the power house and other structures. The new plant will cost $1,000,000. It will be the first of several units, although no further construction will be attempted this year. When the building plans of the company were first announced it was estimated that the total cost of the enterprise would range from $5,000,000 to $8,000,000.

Haynes Automobile Co., Kokomo, Ind., as a part of a plan for enlarging its manufacturing facilities will construct an immense body plant. Fifty automobiles a day will be the output of the new factory, which will be 885 ft. long, 76 ft. wide and two stories in height. Work, it is stated, will be started at once and the building rushed to completion in as short a time as possible. Intimation that the company would provide facilities for taking care of its body work was revealed in these columns several weeks ago in commenting on the program for extending its manufacturing facilities.

Texas Motor Car Assn., Ft. Worth, Tex., is to manufacture bodies and expects to get all the business of the Lone Star state. As superintendent of the new division, the company has secured H. B. Hall, who has been connected with the Fisher Body Corp., the Pierce-Arrow Motor Car Co., and the Packard Motor Car Co. Two years ago he founded the Hall Body Works of Ft. Worth. Actual production of the bodies began in June.

United Auto Body Mfg. Co., Rahway, N. J., at a stockholders meeting on June 9, ratified the action of the board of directors to enlarge the capital stock and to change the company's name to the United Body Corp. This corporation has by this change, a capital stock of $110,000 preferred, and 5,000 shares common of no par value. There will be no public offering of the stock, it already having been fully subscribed for by close private interests.

Fisher Body Corp., Detroit, apparently has reached a new high record in that the net earnings and income for the fiscal year ending April 30, 1920, aggregated $4,367,480.14. Net earnings and income before making provision for interest charges and taxes amounted to $6,747,867.22, which when compared with $3,534,853 for the preceding year serves to show the striking advances made by this organization during the past year.

Longdin-Brugger Co., Fond du Lac, Wis., manufacturer of closed bodies for open passenger automobiles has increased its capital stock from $120,000 to $240,000. It moved into its new factory May 25. The new issue will be used to finance the new plant, equipment and raw materials. Current orders amount to $500,000.

Dayton Body & Cabinet Co., recently incorporated with a capitalization of $50,000, has taken over the Colonial distillery buildings at Trebeins, near Xenia, Ohio, and after alterations are completed will install equipment for the manufacture of commercial automobile bodies. C. C. Breech is president.

Brooks-Ostruk Co., 225 West Sixty-sixth Street, New York, which will soon occupy the plant in Newark, N. J., formerly occupied by J. M. Quimby & Co., buggy manufacturers, is purchasing presses for the manufacture of automobile bodies.

C. E. Hosbach Co., 10 North High Street, Baltimore, manufacturer of automobile bodies, parts, etc., has filed plans for a one story brick machine shop, 40 x 82 ft., on North High Street.

Theurer Wagon Works, New York, has been incorporated with a capital stock of $50,000 by H. and C. Steinka and P. H. Mellmer, 140 Nassau Street, to manufacture wagons, parts, etc.

New England Body Co., North Canton, Conn., has been incorporated with a capital stock of $200,000 by C. H. Pease, J. C. Roraback and Allyn Fuller to manufacture automobile bodies.

Nutley Auto Body Co., 54 Washington Street, Nutley, N. J., has filed notice of organization to manufacture truck and automobile bodies. I. Sidna, 7 Stager Street, heads the company.

Eagle Wagon Works, South Division Street, Auburn, N. Y., manufacturer of dump wagons, parts, etc., has increased its capital stock from $150,000 to $600,000.

E. H. Bule Body & Trailer Works, Fort Worth, Tex., has been incorporated with $50,000 capital by E. H. Buie, V. N. Parris and N. J. Morgan.

Eastern Auto Body Co., Bridgeport, Conn., has filed plans for a one story works on Lindley Street, 60 x 90 ft., to cost about $25,000.

Portsmouth Auto Body Co., Portsmouth, N. H., will soon ask for bids on a small addition to the plant. T. J. Moyan is manager.

Willoughby Co., Dwyer Avenue, Utica, N. Y., manufacturer of automobile bodies will build a new one story plant, 70 x 450 ft.

WANTS

Wanted:—West Tire Setter No. 3, in good condition. A. E. Stevens & Co., Portland, Me.

For Sale:—Wheelwright and auto repair business, established over 25 years. Very conveniently located. Obliged to sell because of death of former owner. For particulars, address G. H. Blume, Railroad Ave., New Rochelle, N. Y.

PATENTS

Patents—H. W. T. Jenner, patent attorney and mechanical expert, 622 F St., Washington, D. C. Established 1883. I make an examination and report if a patent can be had and exactly what it will cost. Send for circular.

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The Automotive Manufacturer

The Hub of Automotive Engineering

BODY BUILDING - AUTOMOTIVE PARTS - ALLIED INDUSTRIES

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The Automotive Manufacturer

The Hub ← A CONSOLIDATION OF → AUTOMOTIVE ENGINEERING

Vol. LXII NEW YORK, AUGUST, 1920 No. 5

Economies of Light Weight Emphasized in New Model Napier

Third in the Series of Post War British Designs Has Airplane Type Engine With Consequently Lighter Weight, Fuel Economy and Lessened Wear—Anti-Rolling Device Increases Riding Comfort

ONE of the best British cars is the Napier, made by D. Napier & Son, Ltd., Acton, London, W. From the beginning this firm's product has been numbered among the high quality cars, in many years showing a marked leadership in design and the introduction of new features. The new post-war design, known as the 40-50 horsepower model, is no exception to this rule, and includes a number of remarkable features, which make the car more desirable from the user's standpoint.

Included with these are the airplane type engine, and the results obtained from its use, light weight and high power, with consequent economies in fuel repairs and depreciation. Probably next in importance would come the anti-rolling device and spring suspension, which bring about maximum comfort in riding. Other features of marked merit include a special frame design, double ignition system, and other well worked out details which will be described.

In a general survey of the car, a complete view with body being shown in Fig. 1 below, it will be noted that it has a wheelbase of 137 in., tread of 56 in., body space of 116 in. length, clearance of 8 in. for home use which can be increased in 9½ in. for overseas use, a six-cylinder motor of 4 in. bore and 5 in. stroke (102 x 127 mm.), rating horsepower of 40 to 50, and brake horsepower over 80. From this it will be seen that it is a large, high powered unit. The chassis price of £1,750 (normally $7,500, at present exchange $6,500) includes a three years' guarantee, and indicates the high quality of the machine, as well as the class to which it would appeal.

In the motor, the idea has been to produce the power with the minimum of weight, the elimination of unneces-

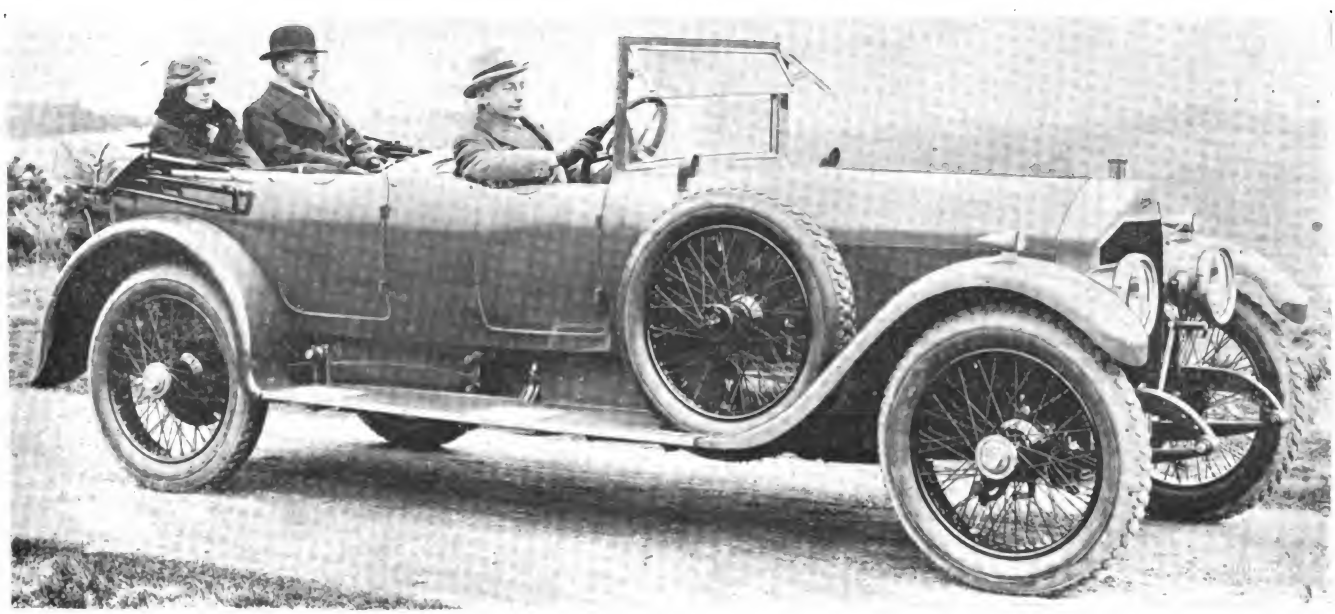
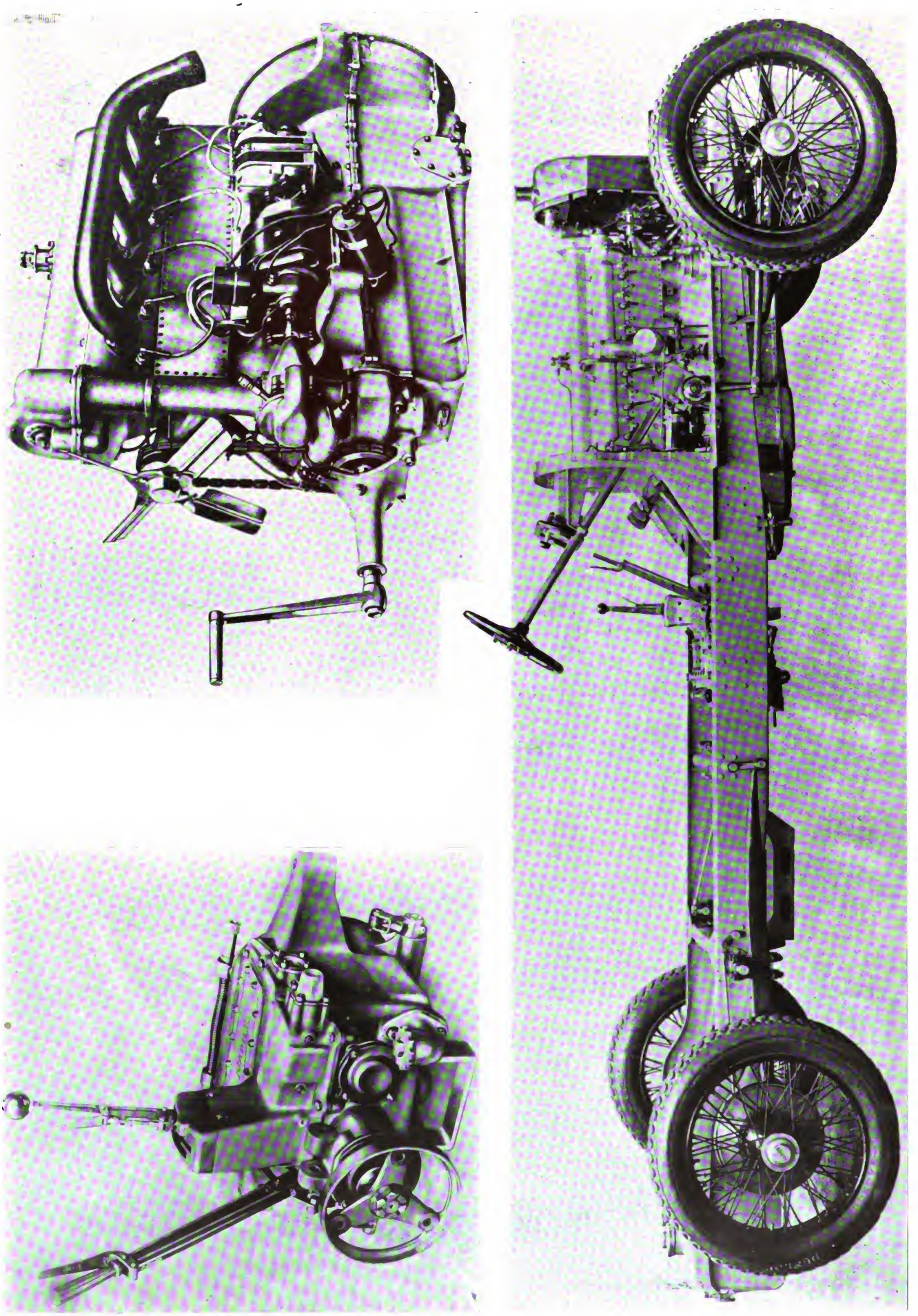


Fig. 1. New 40-50 six-cylinder Napier model equipped with British built five-passenger touring body



Figs. 2, 3 and 4. The 40-50 Napier chassis. Fig. 2, ab ove left, transmission unit with gear shift and brake levers and part of flexible joint. Fig. 3, above at right, ignition side of motor showing disposition of ignition cables. Fig. 4, below, general side view of chassis. Note springs enclosed in leather boots

sary weight bringing about reduced wear and upkeep of tires, and the mechanical parts, also reduction in fuel and oil consumption. A reduction of weight combined with increased power, produced greater speed on the level and superior hill climbing ability. The chassis weight is but 2,700 lbs. (25 cwt.), whereas the brake horsepower is more than 80. This gives a ratio of slightly less than 34 lbs. weight per horsepower. A prominent American car of highest quality and price, of approximately the same general size as this one, weighs 4,600 lbs. with touring body ready for the road, and its motor develops just under 85 brake horsepower. Allowing 1,200 lbs. for the body which is very high, the figures show a ratio of 40 lbs per horsepower. Still another American high class big car shows these figures: Total touring weight 4,750 lbs., which gives 3,650. if 1,100 lbs. be allowed for body; maximum power 86; ratio 42.4:1. These figures give a general idea of the performance of the new Napier, for any motorist can reason out that its lighter weight would make it more lively, that is, give it greater acceleration and deceleration, better in hill climbing or similar long and steady pull, as well as faster on the level.

In design, as Fig. 5 will show, the six cylinders and the upper half of the crankcase are cast as a unit, of aluminum. The wearing surface of the cylinders is formed by inserted steel liners. The water jackets are formed by enclosing the open spaces left along the sides of the cylinders with rectangular aluminum plates. The cylinder head which is detachable and carries the valves and ports is of aluminum, as is also the valve gear cover plate which forms the uppermost part of the engine. The valve ports have screwed-in tungsten steel valve seats and pressed-in bronze guides. The spark plugs which are let into the sides and stand horizontally, are in screwed-in bronze bushings. The overhead valves are located on either side, the camshaft being directly over the center of the cylinders. This arranagement shortens the gas passages, so that the fuel gas gets in more quickly, and the exhaust gases get out more quickly.

The overhead camshaft is operated by means of a vertical shaft and worm and helical gearing. All the valve gear is enclosed by an aluminum cover, on top of which is secured, near the rear end, the pump which supplies air to the pressure fuel tank; this pump is actuated by a special cam on the camshaft. The inlet manifold is cast with, but protudes from, the head, the carburetor being bolted to a flange on a branch depending from the center; the exhaust branch is a separate unit on the left hand side of the head. The metal bearings in the upper half of the crankshaft is supported by seven white metal bearings in the upper half of the crankcase, the lower half being a detachable aluminum casting forming the oil sump. Tubular connecting rods are used, with aluminum straight-sided pistons having three compression rings and one scraper; the hollow wrist pin is fixed in the piston bosses by set screws.

The crankshaft is drilled for forced lubrication to the journal bearings and big-ends, a gear type pump, driven by an extension of the vertical shaft operating the camshaft, drawing oil through a filter in the sump and delivering it through another filter to a steel pipe inside the crankcase leading to the main bearings. Lubrication of the valve gears and camshaft is assured by delivering the oil under pressure through a lead to one camshaft bearing housing, and thence through the hollow shaft to the other bearings. The excess of oil thrown off from the latter serves for the cams and tappets, the surplus drain-

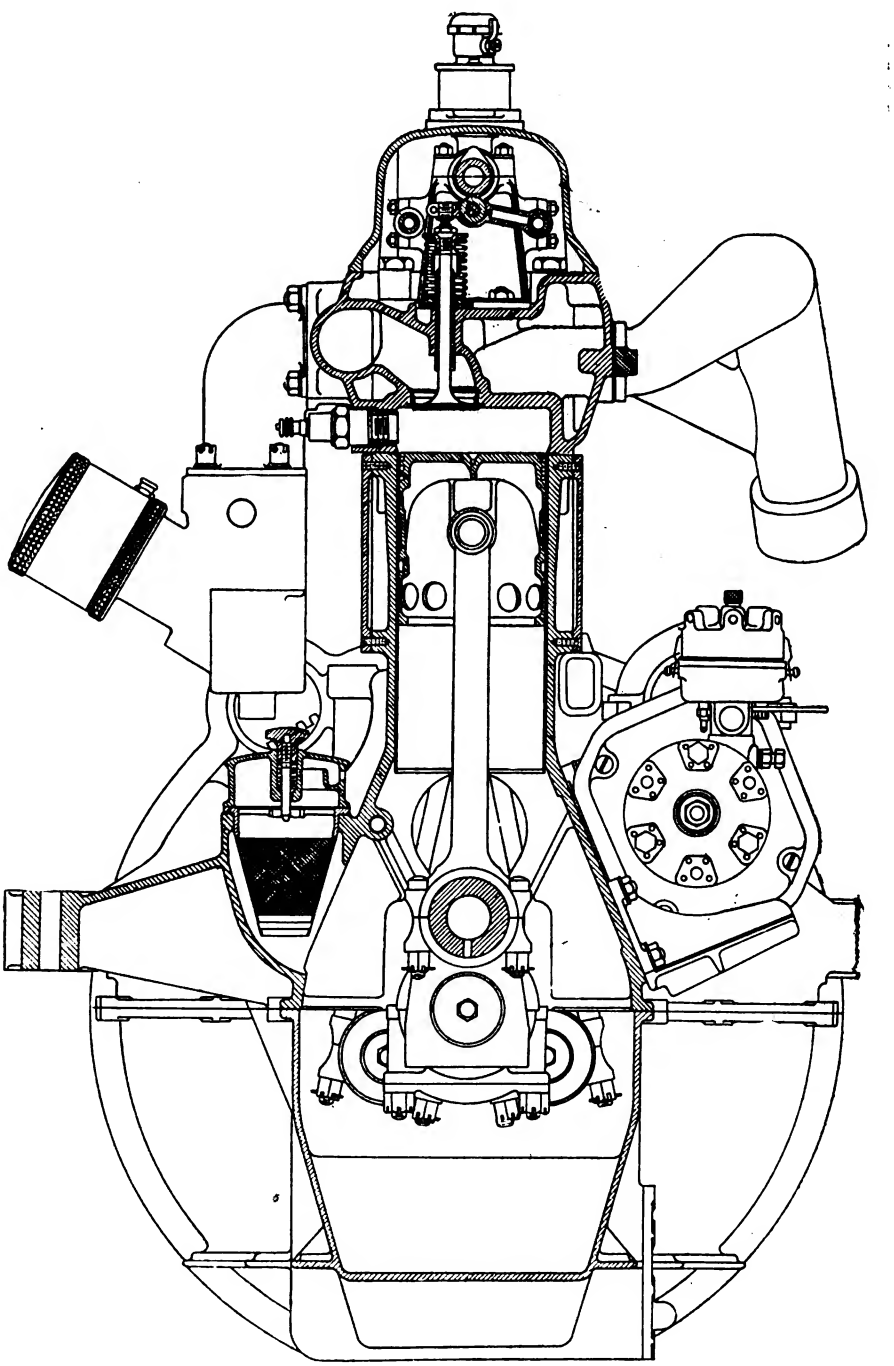


Fig. 5. Section across motor, indicating overhead valves and camshaft, also cylinder liner, and disposition of accessory units

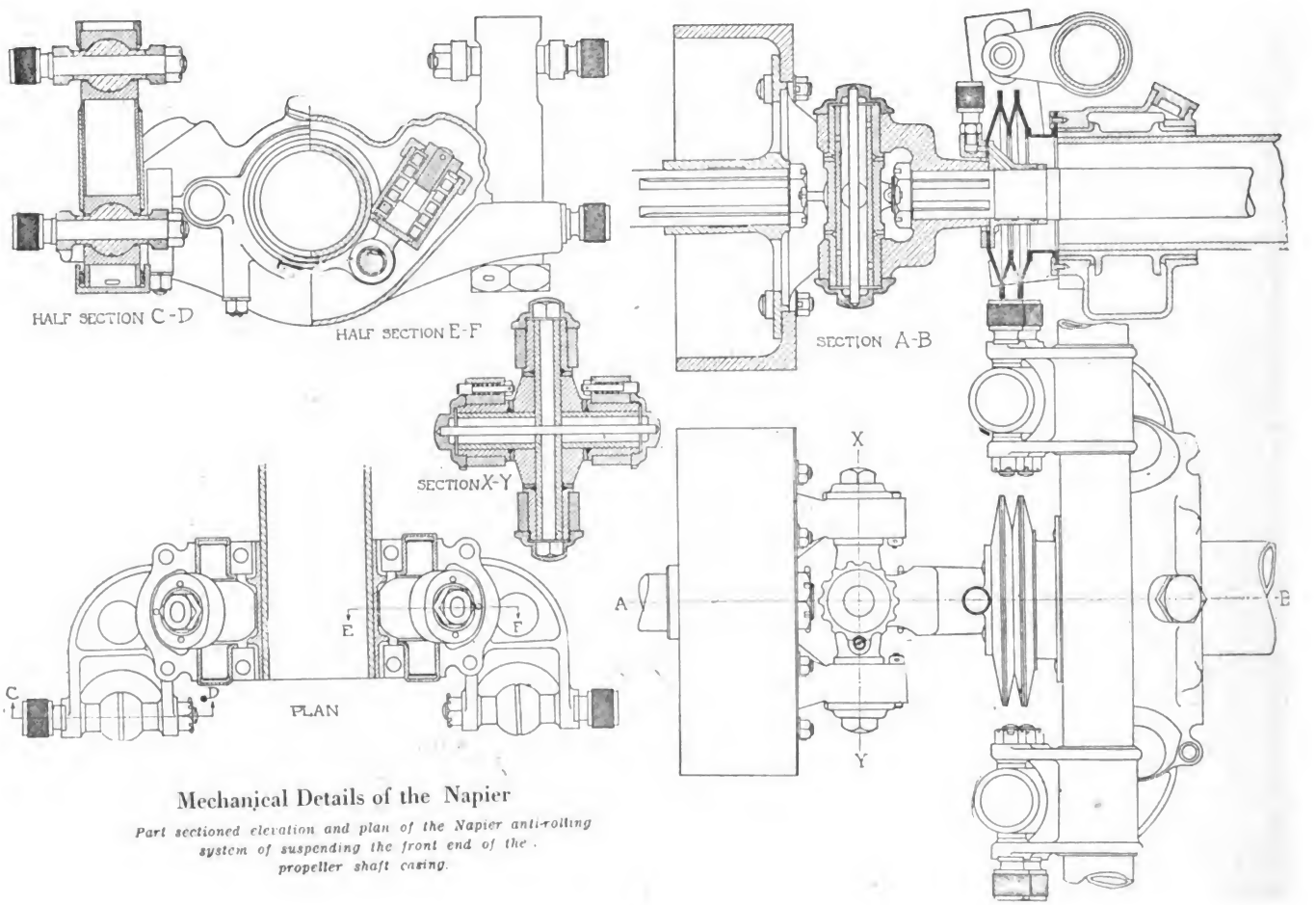
ing back into the camshaft through the driving shaft casing. To prevent over-lubrication of the cylinders, pressed steel baffle plates are arranged between the crank webs and the bottom of the cylinder bores.

As might be expected with an engine of this type, pump circulation is used for the mater, the pump being arranged in front of the distribution casing and driven by a forward extension of the same shaft that serves for the dynamo and magneto in tandem. The two last named units are arranged alongside the crankcase, with a flexible disc joint between them and another between the dynamo and distribution gear. In addition to magneto ignition, an independent system, obtaining current from the batteries and utilizing a coil and distributer, is provided.

The carburetor is of a modified S. U. type, wherein the suction takes effect upon the upper side of a flat piston in an enclosed cylinder; the lifting of the piston serves to admit air by raising a second piston of smaller diameter, which in its nomal position blocks the air inlet passage. A tapered needle valve depending from the air piston projects into the fuel jet and is raised or lowered simultaneously by engine suction. In addition, a supplementary carburetor is used for starting and slow running purposes, this carburetor going out of action as the main carburetor comes into use. The throttle lever over the steering wheel takes effect only upon the throttle of the supplementary carburetor, the usual pedal being provided for the main carburetor throttle. The fuel feed through the main jet is adjustable by means of a lever over the steering wheel, which enables the jet to be lowered or raised relative to the taper needle attached to the floating pistons. Two small pipes lead from the carburetor air intake to the interior of the valve cover, oil-laden air being drawn in this way past the air piston and the inlet valve stems into the combustion chambers, somewhat on the lines of the extra air fitting at one time adopted in connection with the Knight engine on the English Daimler cars.

A single-plate clutch conveys the drive to the gearset through two flexible disc joints and a latticed girder type of coupling. The disc joint against the transmission casing has a metal rim serving for a clutch braks. Four forward speeds and a reverse are provided, the gear and brake levers being arranged above the centr of the box. The shafts run on roller bearings and from one of the gears a speedometer drive is taken. At the rear end of the driven shaft is the drum of an external shoe type brake, the shoes being contracted by means of cams on a transverse shaft.

Special attention has been given to the springing, which must be considered in connection with the device which not alone prevents the chassis and body above the springs from rolling sideways, but holds the car to the road better, and gives better adhesion of the wheels to the road surface so that tire wear is less. This anti-rolling device is built into the chassis at the universal joint forward end, which is directly back of the transmission. Attached to the brake drum, which can be seen mounted on the rear end of the transmission case in Fig. 2, is the driving fork of a star type universal joint, the driven fork being mounted on the spliced end of the propeller shaft, and in connection therewith is a special feature of the chassis. The front end of the tube can oscillate within white metal bearings in a T-head when one back wheel is raised relative to the other, but to prevent "rolling" and undue side



Mechanical Details of the Napier

Part sectioned elevation and plan of the Napier anti-rolling system of suspending the front end of the propeller shaft casing.

sway at corners, the torque tube end has an eye brazed to it at each side, these eyes being coupled by short, stiff springs to the interior of the hollow T-head. Thus any vertical movement of only one end of the axle in relation to the frame is resisted. The head of the casing is itself anchored to a tubular cross member by ball-ended unsprung links, free to move in any direction except vertically.

The theory underlying this form of propeller shaft casing anchorage is that a spring suspension to be ideal should be separately controlled as to (1) its vertical period and (2) its rolling period. In ordinary forms, the springs are designed to give the most suitable vertical period so as to absorb road shocks to the best advantage. but they are not then individually strong enough to hold the wheels on the road or to resist the tendency of the superstructure to sway or "roll," especially at corners. In the Napier system each of the periods is separately under contol, and both the weight carrying and the roll-resisting springs can be varied at will to give the best results in either respect, without one set affecting the functioning of the other. Although the system has only just been introduced in public, it was fitted to Napier cars built in 1914 and would have appeared on those that were to have been at the Olympia show if the latter had not

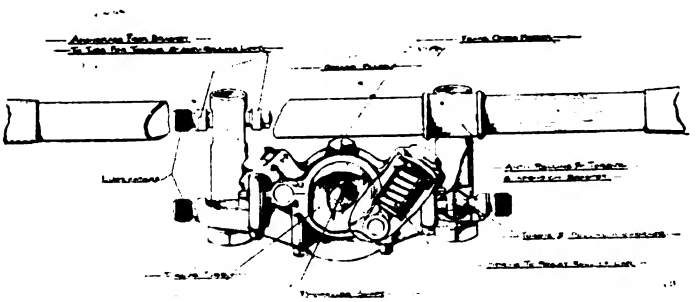


Fig. 7. Sketch to go with Fig. 6 and showing general appearance of Napier anti-rolling device

been abandoned owing to the war. During the intervening period, it has been tested out very thoroughly and found, without doubt, to constitute a great improvement over the older models.

A sliding pot joint occurs between the rear end of the propeller shaft and the final transmission, which consists of helical bevel gearing giving a top gear ratio of 3.75 to 1, the other ratios being: 3dr, 5 to 1; 2nd, 6.75 to 1; and 1st, 12.5 to 1. The rear axle consists of a cast center with two tubular extensions bolted to it and the whole stiffened by a tie rod. Ball bearings are used to support the differential casing within the axle, which is of the full floating type and has roller bearings at the ends to carry the wheel hubs.

Cantilever springs are used at the back and semi-elliptics at the front, all springs being enclosed in leather grease-retaining gaiters. Both springs are very flat, while the leather enclosure gives them a much straighter, flatter and neater appearance. The fronts have ashackle at the rear end, the cantilevers are suspended slightly back of their centers and have shackles at the front nds.

Another interesting feature is the chassis frame. This is of entirely new design, devoid of sharp bends, and of extremely deep section. This design has been provided to nable the maximum rigidity to be obtained which is so essential for efficient carriage work; without it the very best carriage body cannot long remain free from rattles, etc., owing to the strains and stresses set up throughout its construction by the movements and distortions of the chassis frame. It will be seen from the particulars already given as to weight of chassis, that this new design of frame has not been allowed to interfere with the important point of weight reduction. That is, while weight has been saved as much as possible in engine, transmission and elsewhere, the frame has been kept sufficiently stiff and rigid so as to give the right kind of support for the units and body.

The engine carries all the usual electrical accessories, electric starter, dynamo lighting outfit, and two separate ignition systems. The view of the motor, Fig. 3, shows these, the battery-coil-distributor system nearer the front end and directly back of the pump, while the magneto is farther back near the rear supporting arm. The former obtains its current from the lighting and starting battery. The spark advance and retard is by finger lever, located within the steering wheel and working over a nonmoving quadrant. The wires are carried in a conduit along the side of the crankcase, on the left, with the cables on that side going upward directly to one set of plugs, while the wires for the other side pass through bushings set into small holes drilled in the cylinder block between cylinders.

Specifications of New Model Napier Cars

Cylinder bore	Tires
Piston stroke	4 in. (102 mm.)
Number of cylinders	5 in. (127 mm.)
Cooling	6, cast en bloc
Ignition	Water, pump circulated
Ignition current sources	Two complete systems
Spark plugs	Magneto and battery
Transmission	Two sets, either side
Wheelbase	Selective, four speeds
Tread	137 in.
Overall width	56 in.
Overall length	67½ in.
Length of frame available	180 in.
for body	96 in.
Dashboard to center rear	116 in.
axle	8 in., 9½ in. optional
Ground clearance	895 x 135 mm. (35¼ x 5⅓ in

Stable Statistics for New York City

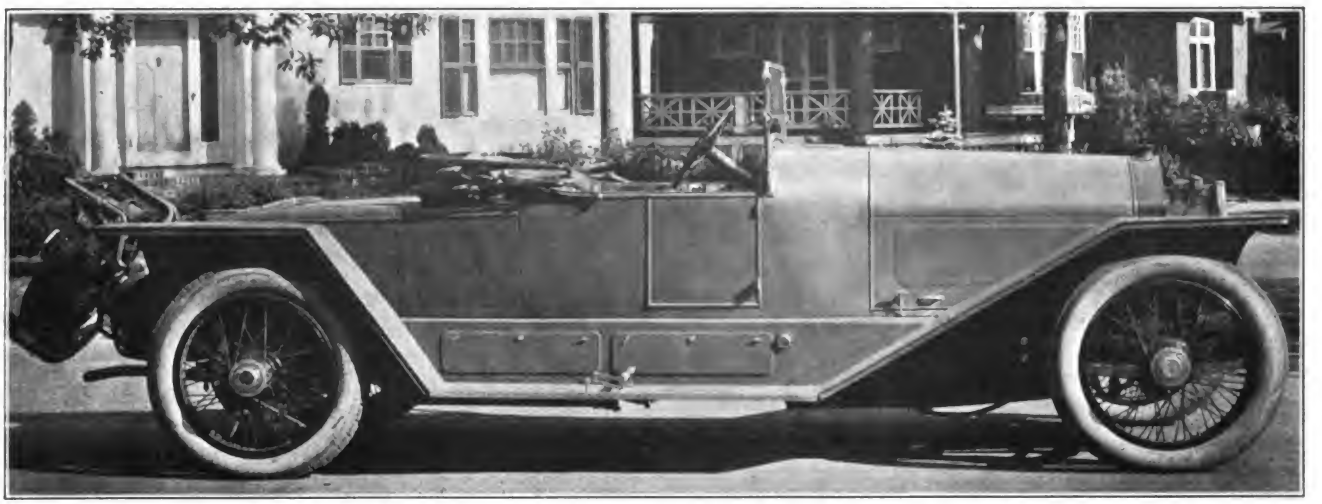
The Sanitary Bureau of the Health Department of New York City has compiled a stable census showing the decrease of stables and of horses in the different boroughs in the last two years. It is not actually as great as it might seem. Following is the table:

	Stables		Horses	
	1917	1919	1917	1919
Manhattan	2013	1577	55653	37825
Bronx	1085	851	8198	7805
Brooklyn	4825	3772	34892	23680
Queens	1934	1152	7108	4665
Richmond	727	568	2185	1765
	10584	7920	108036	75740

The Norwegian Price Control Commission has limited the profits of dealers in foreign cars to 15 per cent on the first 10,000 crowns ($2,680 at normal exchange), 12½ on the next 5,000 and 7½ on any amount above 15,000. This is based on actual cost laid down in Norway, including freight, insurance and duty.

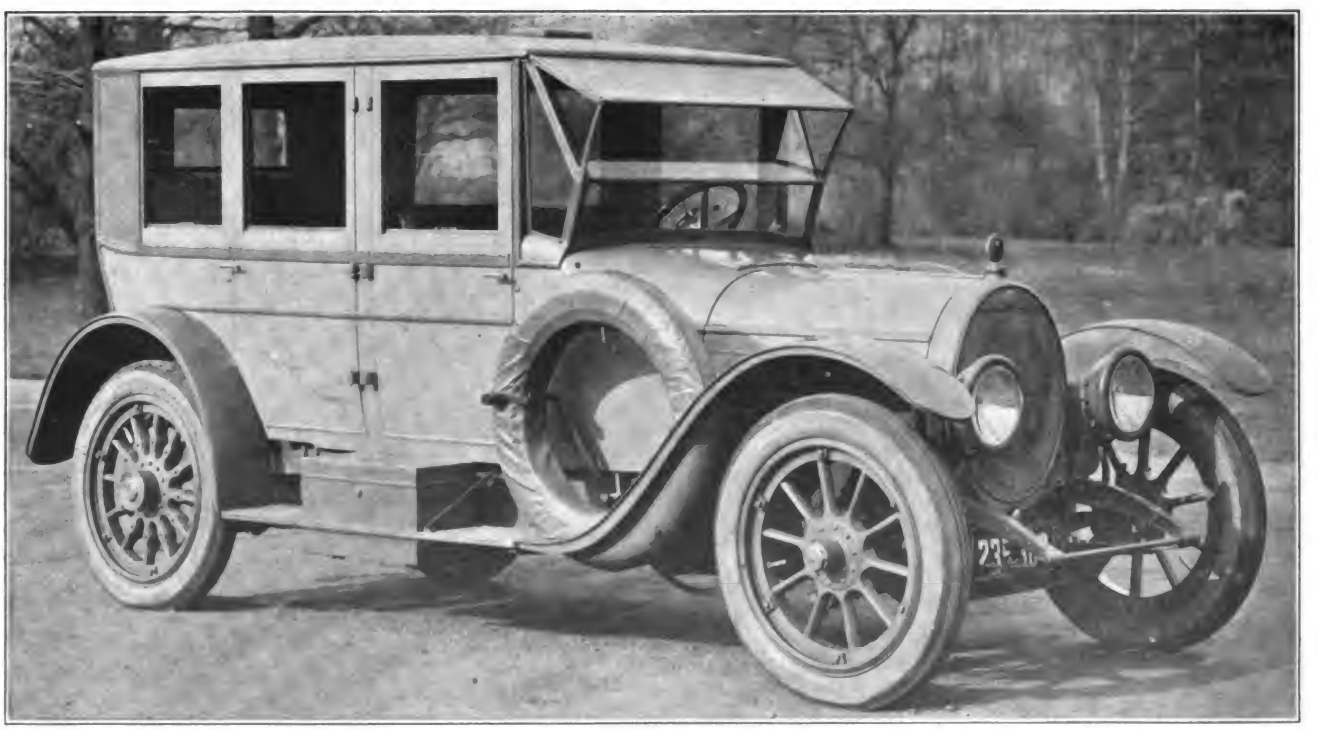
Examples of the Best American Coach Work

Below are shown two recent examples of fine American coach work, mounted on representative American chassis. Compare them with the selected examples of British design and workmanship of the facing page



SPECIAL ROADSTER WITH DISAPPEARING REAR SEAT

Can be used for two, three, four, five or six passengers. Built for Miss Lolita Armour, Chicago, by Custom Body Dept., Locomobile Co. of America, Bridgeport, Conn.

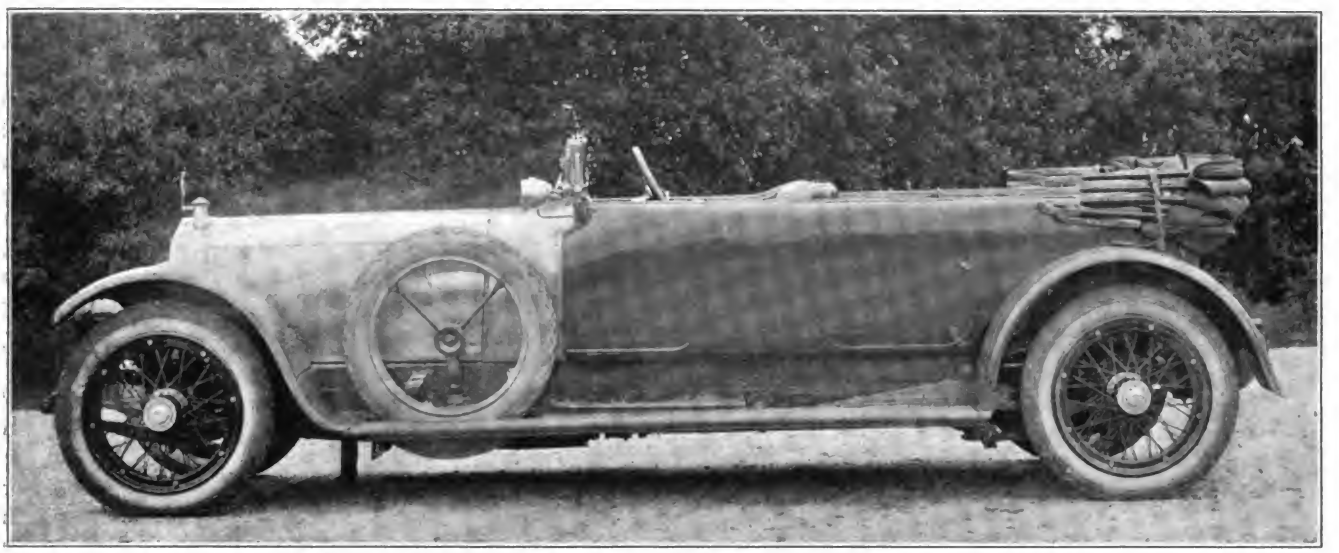


SPECIAL SEDAN WITH PATENTED GLASS FRONT

Five passenger body on Brewster chassis, built by Brewster & Co., Long Island City, N. Y.

Compared With Some of the Finest British Work

These two examples of British coach work, work for which the British have long been famous, are mounted on typical English fine chassis, one of them the highest priced machine in the country



OPEN TOURING FIVE PASSENGER BRITISH BODY

Mounted on Lanchester 40 horsepower post-war chassis, body and chassis by Lanchester Motor Co., Ltd., Birmingham, Eng.

FINE LINES OF ALL-BRITISH SEDAN

This British-built enclosed body is mounted on a Napier 40-50 post-war chassis with Vee front radiator, built by D. Napier & Son, Ltd., London, Eng.

Heat Treating Steel by the Hump Method

What the Method Is and How it Was Named, the Accessories and Instruments Needed and Their Functions, Practical Results Obtained

HEAT treatment of steel has increased to a tremendous extent in recent years through the realization that this was the only way in which the desired qualities of the material could be fitted to the work. In this increase naturally many methods have been adopted, some successful, some otherwise. Also in the use of these methods some special instruments have been developed and have found ready use.

Of all the processes the so-called Hump method has proven to be about the best, and the instruments which have been developed especially for use with this process, or to be exact, just the reverse of this as the instruments made the process possible, have been the most uniformly successful. The method takes its name from a hump formed in the curve traced by the instruments used in the process, which hump forms the vitally important point in the process, as will be explained later.

The hump method, as covered by U. S. Patent No. 1,188,128, utilizes the outward manifestation of changes in internal structure which takes place when steel is heated past the so-called critical or transformation point to indicate when the work should be withdrawn from the furnace. In using this method the temperature of the furnace and therefore of the work, is raised at a uniform rate until the transformation point of the steel is reached. At this time there will be a marked decrease in the rate of temperature rise. This change in the rate of rise is made plainly visible to the operator by an autographic recorder connected to a thermocouple placed close to or in contact with the work. The effect is clearly shown by a bend or hump in the curve as a C, Fig. 1.

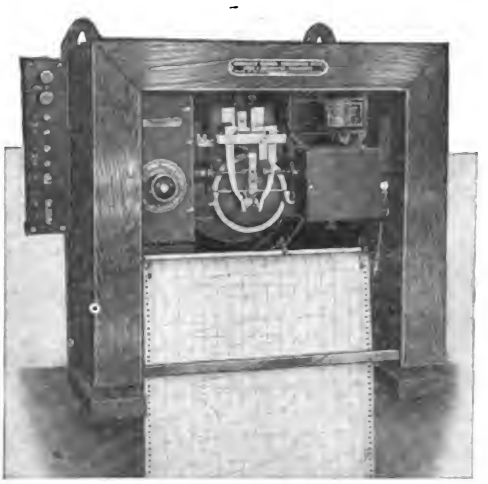


Fig. 1. Curve-drawing recording pyrometer made by Leeds & Northrup and used in their Hump heat treatment method

This hump corresponds to a pause in temperature rise or decrease in rate of heating of the steel, which occurs in spite of the fact that heat is being transferred to the work during this interval as rapidly as before or after. It is explained by metallurgists as being due to the dissolving of cementite, or carbide of iron, in the pure iron or ferrite, and to other chemical and physical changes depending upon the composition of the steel. By microscopical and chemical means it is known that the physical and chemical structure of steel after quenching is profoundly influenced by the relative time of quenching with respect to the time at which the arrest occurs. The hardness, strength, ductility and toughness are all definite influenced.

As a guide in hardening, the temperature pause, or decalesence point, as it is called, is much more reliable than is the furnace temperature as indicated by a pyrometer The arrest in temperature signaled by the hump or bend in the line drawn by the pyrometer pen shows that the internal changes so momentous as affecting the qualities of the finished steel, are actually taking place and once the proper interval to be allowed after the hump before quenching has been determined, there is no uncertainty about the results of hardening.

If on the other hand, the work be controlled with reference to temperature readings only, there are several possible sources of error, namely:

(a) The thermocouple may be at a temperature different from that of the work, due either to insufficient time having elapsed for the work to assume the furnace temperature or to inequalities in temperature between different parts of the furnace. Experiments which have been made with commutating recording pyrometers connected to read alternately upon two or more thermocouples in a single furnaces show how surprising differences in temperature persist even after prolonged "soaking." To insure that the work shall actually reach the desired temperature within a reasonable time, the furnace is often held at a higher temperature, which is afterwards reduced. The "soaking" and possible overheating of the work may, and often do, result in injurious growth in grain in the metal being treated.

(b) In attempting to hold the furnace at a constant temperature, the temperature may fluctuate, and even though it may subsequently be reduced to the proper temperature, the work may nevertheless have been overheated and injured. In the hump method the quench is made as soon as the work is at the right distance above the critical point, and the work is given no opportunity to reach an excessive temperature.

((c) The temperature which is assumed as the critical heat temperature of the steel may not be correct. On the other hand, using the hump method, the time at which each lot of material passes through the critical point is definitely located.

The lead pot and the fused salt bath methods of heating work for hardening give greater assurance than does the ordinary furnace that the work shall reach a uniform temperature, but there still remain uncertainties as to the actual transformation temperature and as to accuracy of the temperature measurement, and growth in grain size due to too long immersion may occur. Lead or salt baths give no control whatever of the rate of heating. Hardening baths also have many practical disadvantages, such as expense, dirt, necessity of subsequently cleaning the work, space occupied etc.

(d) The pyrometer used for measuring furnace temperature may be incorrect.

The user of the hump method need not concern himself about the absolute accuracy of his pyrometer, nor bother with independent transformation point determinations. It is not at all necessary that the temperature of the work, for so long as the recorder connected to the thermocouple shows clearly the pause in temperature rise, the moment at which transformation occurs is definitely known. Having learned by trial just how many minutes should elapse after the beginning or end of the transformation before the work is removed from the furnace, he is upon sure ground and can repeat results.

Uniform, standardization conditions and a control of the rate of heating the work are essential to the hump method of heat treatment. A small furnace element consists of a vertical, cylindrical resistor, surrounded by insulating material in a sheet-iron jacket. The register rests upon a refractory block, which is supported by a cast-iron bottom plate. The heating chamber is closed at the top by a refractory cover, while a cast-iron top-plate confines the loose insulating material, filling the space between resistor and jacket. An iron-constantin thermocouple of bare No. 8 gage wire projects upward from the center of the bottom refractory block.

By means of a small wire attached to a tool support on the top plate of the furnace, the work to be treated can be suspended in close proximity to, or touching, the end of the thermocouple. In production furnaces other methods of supporting the work are used. For example, in the furnace shown in Fig. 3, designed for heat treatment of automobile transmission gears, the work is placed upon holders before insertion in the furnace. Covers placed on the surface completely close in the heating chamber, preventing renewal of the atmosphere, and the work is thus protected against oxidation and scaling.

At the moment when the work is introduced into the furnace, the temperature of the latter is, say, 1,400 deg. F, but the heat storage capacity of the furnace walls being small compared with that of the charge, the temperatures of both thermocouple and furnace wall drop rapidly a few hundred degrees, the current through the heating element or resistor being shut off during this time. The result can be seen in the chart made by a curve drawing pyrometer connected to a thermocouple located in a furnace operated in the manner just described, as reproduced in Fig. 1. The temperature drops rapidly from 1,400 deg. F at A to about 870 deg. F, and then rises slowly to B, where it is stationary, the thermocouple, furnace walls, and all parts, small and large, of the charge having reached approximately the same temperature. The switch is then closed, the input being so regulated that the temperature rises at the desired rate. The fact that the work and furnace start from the same temperature at B, far below the critical point, coupled with a proper arrangement of the heating element, with respect to the charge, insures that all parts of the work will go through the critical point at the same time. This is desirable in order to avoid stresses and distortion that would follow from unequal expansion or contraction if different parts of the work passed through the transformation point at different times.

The arrival of the work at the transformation point C causes an abrupt change in the rate of heating, due to the suddenly increased capacity of the steel to store heat, the temperature stops rising or proceeds much more slowly than before, although the rate of supply of heat energy has not been changed however once the transformation is completed, as at D, the temperature again rises rapidly. The pause is plainly shown by the hump in the curve.

Before quenching, it is necessary to heat the work for a certain time after this point, the time depending on the mass and shape of the steel, the quenching medium employed, and the qualities desired. The exact further heating to be allowed after the completion of the transformation point is learned by experience or trial, but once known, all uncertainty as to the result is practically eliminated.

In using the hump method, the metal is quenched without hesitation, as soon as the pen has gone the prescribed distance past the "hump" which indicates the transformation point. Errors due to inaccuracy of pyrometers, nonuniform temperature in the furnace, failure of the work to reach the furnace temperature, or incorrect information regarding the transformation temperature, are avoided, and the steel is not injured by overheating or by holding it at a high temperature for too long a time. Each piece of work carried the same distance beyond the refer-

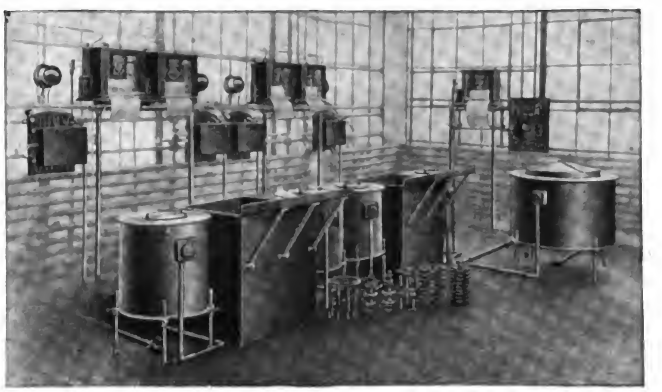


Fig. 2. Electric furnaces and recording instruments heat treating automobile gears at Dort Motor Car Co., Flint, Mich.

ence point C or D will show the same internal structure. This is true whether or not the temperature represented at the point C or D will show the same internal structure. This is true whether or not the temperature represented at the point C on the chart is correct, and whether or not it is the actual temperature of the steel at that moment. The important fact is that the chart tells the attendant when the steel is going through the transformation from which he may know that quenching after a certain interval will secure the desired physical qualities. Furthermore the chart remains as a record of just how each individual lot of steel was treated, and can be referred to in connection with properties developed in physical tests of that steel.

It is found that the rate of temperature increase has a marked influence upon the properties exhibited by the steel after quenching. The resistance furnace is admirably adapted for controlling the rate of temperature rise, since the rate of energy input is easily regulated by reference to an ammeter supplied as part of the furnace equipment. The potentiometer pyrometer is likewise peculiarly suited for carrying out the hump method of heat treatment, as it is sensitive to small changes in themocouple e.m.f., and exhibits changes in rate of temperature rise

upon a magnified scale. It is, in fact, the only form of pyrometer having these qualities in the desired degree.

As an example of the use of the electric furnace in hardening tools, the manner in which punches and dies are produced in a shop where this method has been exclusively for the past six years will be described. One

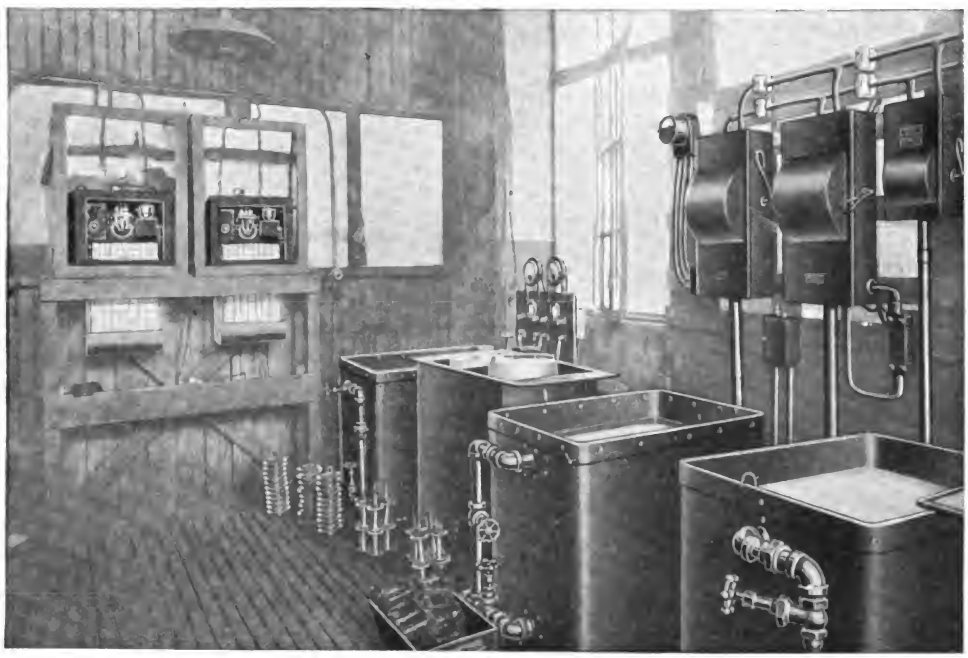


Fig. 3. Heat treating equipment of Packard Motor Car Co., Detroit, used on gears for Liberty motors by the Hump method

of these punches and dies is shown in Fig. 5. The punch is first made in the ordinary way by machining and hand finishing. It is easy to secure accuracy in the making of a punch, as all measuring, gaging, etc., is done on the outside. The die is made to approximately the correct size, but slightly smaller. The punch, having been hardened and ground to exact dimensions, is then used as a broach to cut the die. It is forced into the die a short distance, raising a burr, which is removed by filing, the operation being repeated until the cut is finished. The die is then relieved, but no further work is done on the cutting edge. After hardening the die by the hump method, the size and shape are found to be so exact with respect to the punch, that subsequent work, as stoning or grinding, is not required.

Dies which have been broached by the punch and then hardened by the hump method are superior, for purposes where close correspondence of punch and die are necessary, to hand-made dies hardened in the ordinary manner. Hand-made dies must be corrected by hand work after hardening, and such hand work can be guided only by reference to a templet. It is practically impossible to make the templet exactly the same shape as the punch, and it is also difficult to make the die fit the templet exactly. Even on work where internal calipers or micrometers can be used, it is not practicable to make a die exactly the same shape and size as the punch, as any hand work is necessarily more or less irregular.

The fact that dies hardened by the hump method fit exactly with the punches by which they are broached, shows that there has been no volume change or distortion during the process of hardening. It has been found however that the previous history of the material, the rate of heating and the interval which is allowed to elapse between the transformation point and the quenching point has certain relations to volume changes which are of great importance in the hardening of such objects as dies, milling cutters, gears, etc.

Comparisons made in the instrument shops of the Frankford Arsenal of taps hardened in an electric furnace by the hump method with taps hardened in a gas furnace indicate that superior physical qualities, as shown by increased life, are obtained by the hump method. The gas furnace was of the partial muffle type, burning illuminating gas. The lecetric furnace was, after brief instructions operated by the same man who had been hardening taps in the gas furnace for several years. The following is a summary of the results.

The taps were 1.504 in. in diameter, had 12 threads per in. and were used in tapping fuse holes in 3 in. steel projectiles. Tests were made on taps from four different brands of steel. The figures in the table represent the number of holes tapped after each grinding.

	New	1st re-grind	2nd re-grind	3rd re-grind	Total	Increase in life
Brand A						
Av. (7) gas treated...	29	204	86	65	384	
Av. (2) elec. treated...	100	270	33	103	506	32%
Brand B						
Av. (7) gas treated...	84	151	25	36	296	
Av. (2) elec. treated...	7	384	26	20	437	48%
Brand C						
Av. (9) gas treated...	94	210	207	9	520	
Av. (8) elec. treated...	414	232	129	8	782	50%
Brand D						
Av. (7) gas treated...	131	243	340	71	792	
Av. (2) elec. treated...	520	107	350	10	987	25%

With each brand of steel therefore taps hardened in the electric furnace showed a greatly increased life over those hardened in the gas furnace.

Except with Brand B, the average is very marked before the first regrind. The fact that these taps averaged 384 holes after the first regrind indicates that the fault is not in the hardening, but in some unavoidable feature in the grinding, or in the use of the taps. The outer case of the taps should be the hardest, and if the tap is held to shape in hardening, more of its hard surface remains for use. This would probably be the case in the electric furnace and might account for the greater life before the first regrind. Then again there is more decarbonization in the gas furnace, and this would cause the surface to be composed of low carbon steel, which would not be good for cutting purposes. The life of a tap would naturally be expected to decrease gradually as in Brand C (electric

treated). In the electric furnace the work is heated in a neutral atmosphere, and emerges practically as clean after hardening as before it was placed in the furnace, saving considerable in time and money for finishing.

Production operations are greatly simplified by the use of electric heat treating furnaces with the hump method. As an example refer to Fig. 3. Formerly in this plant automobile transmission gears were heated for hardening in lead pots located in the basement beneath the machine shop. After the gears had been machined, they were removed on trucks to an elevator, lowered to the heat treating room, an uncomfortable place because of heat and fumes, and wheeled to the lead pots. The gears were placed in the lead pots in batches, and when they had come up to temperature, were lifted out one at a time and dropped into the oil quenching bath. The time of heating in the lead pots was thus not the same for all pieces, and the temperature also varied with the location in the pot, possibly resulting in non-uniform hardness and grain structure. The gears were also sometimes injured by dropping upon one another in the quenching tank. The drawing was done in gas furnaces, followed by an oil quench. Upon their return to the machine shop, the gears were wire-brushed to remove adhering lead.

The electric furnace equipment replacing the lead pots and gas furnace is located in the machine shop itself and is shown in section in Fig. 4. There are six electric hardening furnaces located on two sides about a quenching tank, with three electric annealing furnaces on the remaining side, also a drain grid and the cleansing bath between the quenching tank and the annealing furnaces. The tops of all furnaces and tank are flush with an elevated platform. The work is brought on trucks to the edge of the platform, where a boy arranges the gears upon holders, which are easily picked up by the operator, and upon which the gears remain until they have passed in turn through hardening furnace, quenching tank, cleansing bath and drawing furnace. Corresponding to each hardening furnace there is a curve drawing recorder, and for each drawing furnace an automatic temperature recording controller

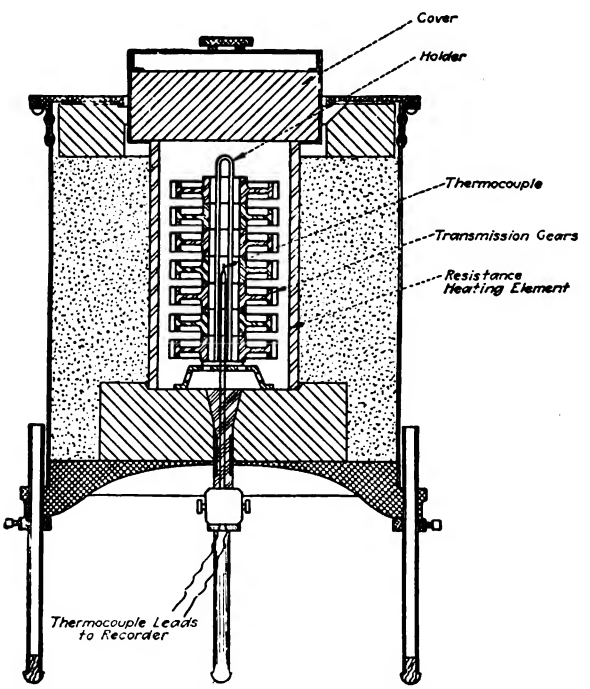


Fig. 4. Section through the Packard electric gear treating furnaces showing construction

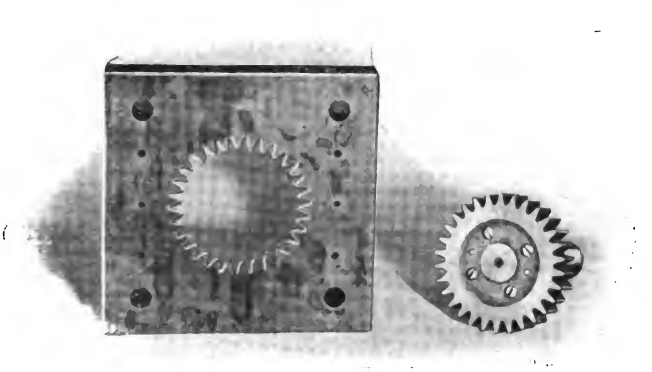


Fig. 5. Punch and die hardened by Hump method. Die was broached by the punch and fitted punch exactly after hardening

all mounted upon a wall near by, where also are the furnace rheostats.

The amount of electrical energy consumed by the electric furnace is comparatively little, due to the very efficient insulation. There is no loss of heat in waste gases, as with combustion furnaces, leaving to be supplied only the heat imparted to the work. The higher cost of electrical energy is more than repaid by the saving in necessary apparatus, such as pumps, blowers, burners, etc., and the labor costs, as the electric furnace can be located in the machine shop in the direct line of manufacture, thus saving the double handling of the work which is necessary where the latter must be taken from the machine shop to a hardening room and then back again.

The use of the hump method in regular manufacturing results in a higher grade, a more uniform output, and simplifies handling and cleaning to such an extent as to render the cost of electrical energy of minor importance. Dependable results and large volume of output are obtained with regularity and certainty, and without requiring a large number of skilled men.

Where electric furnaces are used in the tool room, the tool maker can be closely in contact with the hardener, so that methods of operation in tool making, which often increase the difficulties of the hardener, lan be avoided, while through the use of the hump method it is sometimes possible to simplify the work of the tool maker as related in connection with die making.

The hump method of heat treatment is controlled by the Leeds & Northrup Co. of Philadelphia, which company also manufactures the electric furnaces and curve drawing pyrometers used in carrying out the process. Hump method equipments for hardening tools and dies have been installed by such concerns as the Ingersoll-Rand Co., the Miller Lock Co., the Westinghouse Eelectric & Mfg. Co., the Standard Tool Co., etc., while equipments for large scale commercial production are used by the manufacturers of the Packard, Hudson, Dort and Nash motor cars, by the Detroit Gear & Machine and Brown Lipe Gear Companies, and other well known concerns in the automobile field.

For the year ending June 30, the foreign trade of the United States totalled $8,111,176,131, a decided increase from the $7,232,282,686 of the corresponding period of last year. This was despite a decrease for the month of June, $631,000,000 this year as compared with $928,379,-203 last June. The big changes came in a marked increase in importations which were double last June's, and a falling off of one-third in exports

Proper Box Strapping Saves Goods and Containers

By W. SHERIDAN HUSS

In Present Acute Shortage of Materials and Manufactured Goods to Lose or Waste Any Is a Crime—Method of Packing Which Guarantees Against Loss—Simple, Inexpensive

ONE of the two reasons for packing shipments is to make it posible to handle them easily and economically in transit and in storage. The other is to protect the goods during transportation.

There is no other means which will strengthen a box and protect its contents as greatly as reinforcing it with steel strapping. Actual laboratory tests have shown that it is possible to increase the strength of a package from 100 to 300 per cent by the proper application of steel strapping. Further, thickness of material may be reduced, thus reducing the actual cost of the container. The saving in the cost of material is more than the cost of the straps, so that the shipper receives a much stronger package at a substantial saving.

Fig. 1. "Doubleedge" box strapping

Fig. 2. "Nailezy" bob strapping

Fig. 3. Diamond split box strapping ..

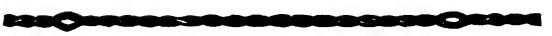


Fig. 4. Twisted wire box strapping

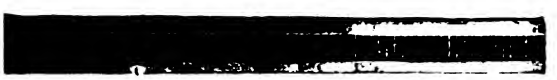


Fig. 5. Turned edge box strapping

The proper reinforcement of containers is a factor to be considered by every manufacturer. This statement is borne out by the fact that during the war steel strapping was regarded of such importance by government officials in charge of packing and shipping, that many of our best trained engineers were continuously delegated to make a study of package designing, including the baling of all material possible to be baled Cargo room was at a premium and all commodities had to be packed in the least possible space, and millions of dollars were saved through the baling of various government materials. Steel strapping enabled the accomplishment of these result.

At the present time, the United States Government is carrying on a thorough investigation in the Forrest Products Laboratory at Madison, Wis., for the purpose of developing the scientific use of box strapping, its proper application, and determining the correct widths and gages for the various sizes and weights of boxes, and the economies that can be made through the use of box strapping.

The width and thickness of strapping which should be used depends upon the size and gross weight of the package. On boxes up to 100 lbs. gross weight, where the size is not excessive, strapping ½ in. x .018 thick is generally considered satisfactory. On boxes over 100 lbs. gross weight or on boxes of large size, stronger strap should be used, perhaps ⅝ in. x .020 or ¾ in. x .015, each of which has a tensile strength of about 1,200 lbs. Large and heavy packages practically demand the use of strapping because the heavier packages receive the greatest amount of strain in transportation.

Fig. 6. Punched box strapping

Fig. 7. Wooden reel and reel stand

There are two large divisions of box strapping, nailed and nailless. Figs. 1 to 6 illustrate a few of the many styles of nailed-on box strapping. These strappings are made in several gages and widths, put up in coils, single and double wound, and in cut lengths, in bundles. The coiled strapping is used from coil holders or from wooden reels and stands, Fig. 7.

Of great importance in the proper strapping of boxes is the drawing of the strap tight around the box. The reinforcement value of the strapping to the box depends in a large measure upon the degree of stretching given the strapping while it is being nailed.

Fig. 8 illustrates a patented box strap stretching tool, which is efficient and fast in operation, Fig. 9, and which will handle the various styles of strapping illustrated.

A new thought in box reinforcement is what is known as nailless strapping, Fig. 10. Fig. 11 shows one of the

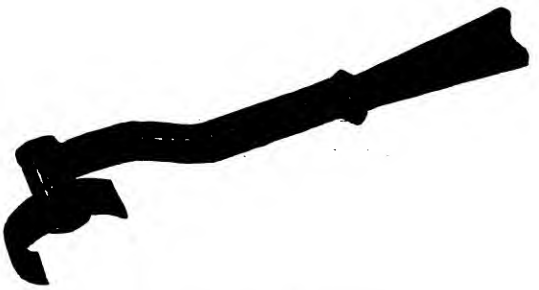


Fig. 8. Box strap stetcher

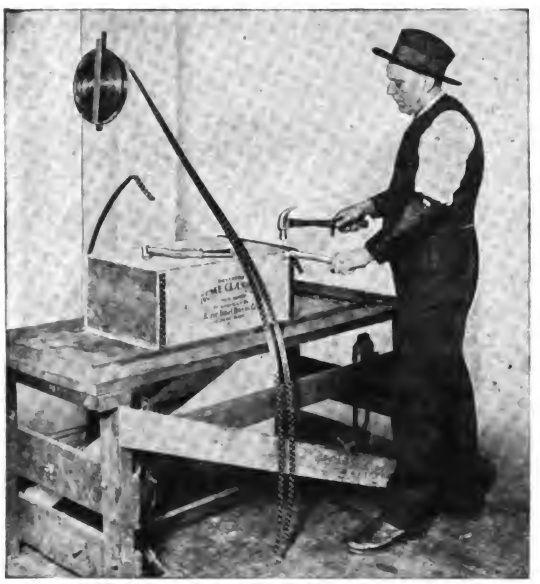


Fig. 9. Illustration showing use of box stretcher

Fig. 10. Nailless strapping with seal applied

Fig. 11. Applying seal to strap after strap has been drawn tight and cut

Fig. 12. Revolving drum in which boxes are tested

operations of the patented Acme nailless strapping system, which provides a method of placing the strap around the package, drawing it to a high tension by means of a stretching tool, cutting the strap, and then fastenings the ends wih a metal seal. This system is adapted for use in properly securing boxes, bales, bundles—practically all commodities transported. The strapping used with this system is made of a special analysis steel, heat treated, and has a very high tensile strength.

The cost of strapping for the average package will approximate from ½ to 3 cents per package. Comparing this with the cost of the contents, and considering the absolute protection given to the shipper and carrier, and the saving made through the possible reduction in the thickness of material used, every shipper of commodities of any nature should seriously consider the steel strapping of his cases. The cost is so small when compared with the reults obtained, that the average shipper would make a return of several hundred per cent on his investment.

The experimental work which has been done by the United States Government Forest Products Laboratory has given dependable rules which are applicable to the packing of all commodities. Guess-work will not properly reinforce a package any more than it will build a box, that is if the shipper expects full economy and safety. If goods are to be protected and their safe delivery guaranteed, there are certain standards that must be met.

Present indications point to the forming of regulations which will call for the use of box strapping on all shipments moving by railroad or steamship transportation. This will furnish the shipper and carrier absolute protection, will enable the package industry to recommend lighter containers for a majority of commodities, and will eliminate the great economic waste going on annually.

To date 42 cooperative organizations, with a total of 734 members and representing about 1,000 plants, have been formed to stimulate export business under the Webb-Pomerene act, which was formulated for this purpose. Of these 118 are in New York, 87 in Pennsylvania, 46 in Wisconsin, 96 on the Pacific Coast and the rest all over the country.

In March more than 46,000 cars were driven overland to deliver because of difficulty in obtaining railroad cars for shipment. In April the number increased to about 61,000, in May to more than 68,000, and in June it exceeded 86,000. Lake and river boats are being used as far as available.

New Hardness Testing Machine Has Wider Range of Action

Description of New Outfit Which Is Said to Test Shapes Which Other Machines Can Not Handle Advantageously—New Principle of Action

REALIZATION in recent years that the best in metals could only be had through suitable heat treatment and the proving of this quality through suitable instruments has created a great demand for testing instruments, particularly hardness testing instruments. There are and have been available for years, splendid and accurate hard-

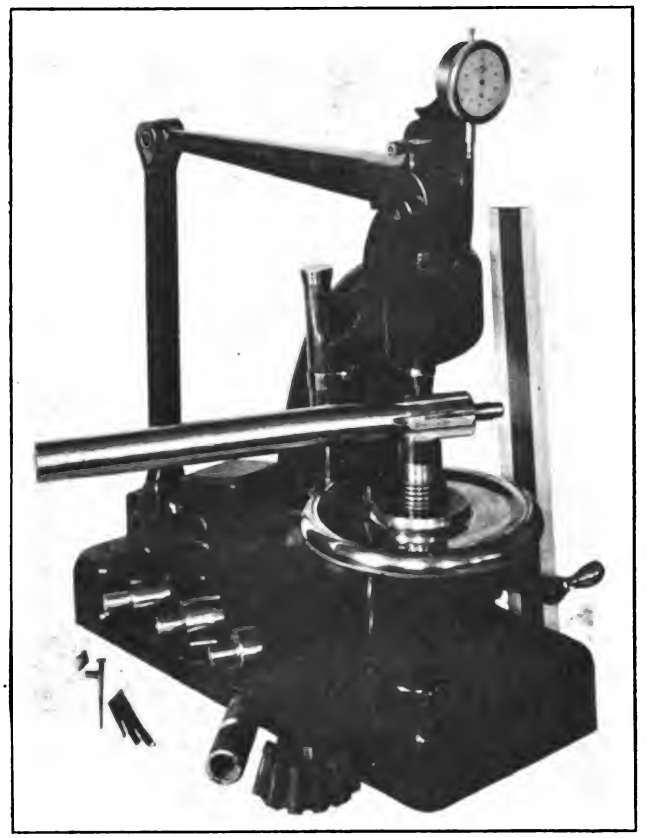


Fig. 1. Rockwell Hardness Tester working on round section automobile shaft

ness testers, but all ot fhese have some limits, some hampering method of construction or use. For many years metal workers have felt the need of a hardness tester that combined the good qualities and eliminated the undesirable feateures of the usual type of harness testing machines, Such a testing machine should be accurate, adapted to testing curved surfaces as well as flat, thin as well as thick sections; portable, rugged in design, fast working, should not mar excessively or destrop the tested work and should be able to compare the various extremes of hardness ranging from soft to the hardest steel.

These conditions, it is claimed, have been met in the Rockwell harness tester, illustrated herewith.

The first model was made on the horizontal plan and was designed to test the hardness of the concave raceways of ball bearing cups and cones. The success of the first models caused a number of special machines to be built for testing the hardness of various automobile and fire arms components.

Later the demand came for a universal machine which could be manufactured in quantity so that the cost would be within reach of all. The vertical type is the result. It fits nearly all the hardness testing requirements occurring in manufacturing today.

Description of the Rockwell Hardness Tester

A sturdy hollow cast frame, Figs. 1 and 2, together with a plunger which holds the testing point at one end abuts against a delicate measuring device at the other end. A series of levers with knife edges connects this plunper with a weight. By shifting the position of this weight more or less weight can be applied to the testing point at will to suit conditions of the work. Application and release of this weight called the final weight is controlled by a hand lever. To regulate the fall of this weight a dash pot on the regular equipment is provided. A vertically movable chuck holder, actuated by a hand wheel, raises and lowers the work under test. Four chucks capable of holding a great variety of work are provided.

The article to be tested is placed on the chuck, round section in the notch, Fig. 1, flat sections on the flat surface, Fig. 2. The work is raised on the chuck by the hand wheel till it comes in contact with the testing point. At this moment an initial pressure is applied through the point to the work. This initial pressure is to cause the point to break through the light scale, decarburization, etc., in order to test the true metal beneath and to seat the article firmly and prevent shifting. The upward movement of the work is continued until the plunger has actuated the measuring device to a degree sufficient for testing. The final weight is then applied by the hand lever and released. The hardness is read direct by the difference of the testing point's position indicated by the measuring device. The chuck is then lowered by the hand wheel, the article removed or shifted and another test made. A degree of elasticity of the metal is also determined by noting the measuring device or test point

Fig. 2. For strip steel or flat pieces a flat surfaced anvil is substituted

difference from final pressure to initial pressure. The average operator can readily make ten tests per minute. On practice fifteen tests can readily be made.

Hardness Testing With the Rockwell Machine

The Rockwell test is made by forcing an alloy steel point under a constant pressure into the work under test. The work is first subjected to an initial pressure against the testing point that firmly seats it and forces the point through to the true metal when light scale an decarburization is present. In the diagram, Fig. 3, this is represented. The untested surface is represented by o, a represents the enlarged depth of impression made by the testing point when initial pressure is applied. When the initial pressure has been applied the pointer on the indicating dial stands at zero. The final pressure is then applied by the hand lever and the point imbeds itself into the work to the depth shown by c. The initial pressure and the final weight are independent of each other The final weight is now released and the initial pressure again is brought to bear on the work returning to condition as at start of test. Due to various hardnesses of the work under test the metal closes up, due to its elasticity not having been entirely destroyed at the depth of test and the test point is forced back to b; a-b then is the depth of permanent impression on the tensile hardness and b to c the elastic hardness including the elasticity of the machine which is constant at each final weight setting. Each of these readings is indicated on the dial. The tensile hardness a to b is the hardness most generally used.

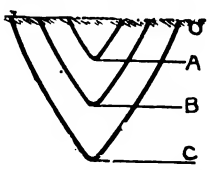


Fig. 3. Sketch showing Rockwell method of operation

The elastic hardness can only be used where there is no deformation in the total mass of the work itself such as would occur in light tubing. In this latter case the final pressure exerted on the work will often deform same. To guard against this the final pressure is reduceable at will to meet such conditions. The hardness numbers indicated on the dial are convertible by the chart, Fig. 4, to Brinell and Scleroscope hardness numerals. The dials may also be calibrated in Brinell or Scleroscope.

Surface preparation is seldom needed, the initial pressure taking care of this. At most a slight rubbing with coarse emery cloth is satisfactory on heat-treated work. Sand blasted, tumbled or box annealed work requires no polishing to obtain good accuracy.

For quantity testing the machine is used comparatively by first ascertaining hardness by any standard method of test and then separating the work into three classes—too hard, too soft, and satisfactory. As the indicating dials are of a standard make an additional pointer may be used, the angular difference of the pointer to represent the allowable hardness variation. If in test the pointers straddle the point on the dial representing the mean of satisfactory hardness the work is satisfactory, if both pointers are clockwise of this point too hard, and if counterclockwise of this point too soft.

Adaptability of Rockwell to Miscellaneous Work

Springs—The thin ribbon spring is about the hardest article to control as regards uniformity of temper. The usual test is a compression test of from 24 to 48 hours, noting deflections under certain loads. This for a standard is satisfactory but, when large quantities are tested time and equipment for so testing is a vital fartor. Other instruments are of little value when on this kind of material. A properly tempered spring is of course file soft. Yet the Scleroscope will show a thin spring of the 1/32 in. thick to be 80 or over and 80 on a 1 in. block will be file soft.

Sheet metal—Sheet metal may be readily tested before shipment throughout the length of the coil or strip without destroying or cutting the work.

Gun and typewriter parts—These components are often heat-treated to give various hardnesses at different points After hardening all over they are file tested, then drawn and certain parts rehardened and then all redrawn at a less degree than at first. The Rockwell is particularly adapted to this work as the components' shape and size do not permit testing with Scleroscope or Brinell and the file is not accurate enough.

Forgings—For small forgings this machine separates quickly the good machining from the poor without the usual surface preparation required by the Brinell.

Cast iron—Small castings often come in poor machining qualities. The Rockwell will determine this and not crush the casting as the Brinell will often do. As a rule a sand blasted surface is sufficient for testing.

Broaches, drills, cutters, etc.—The Rockwell tests these tools on the land and in this way shipments received may be checked up against standards which have been proved satisfactory.

Chain parts—The Rockwell serves to test these accurately and quickly independent of size.

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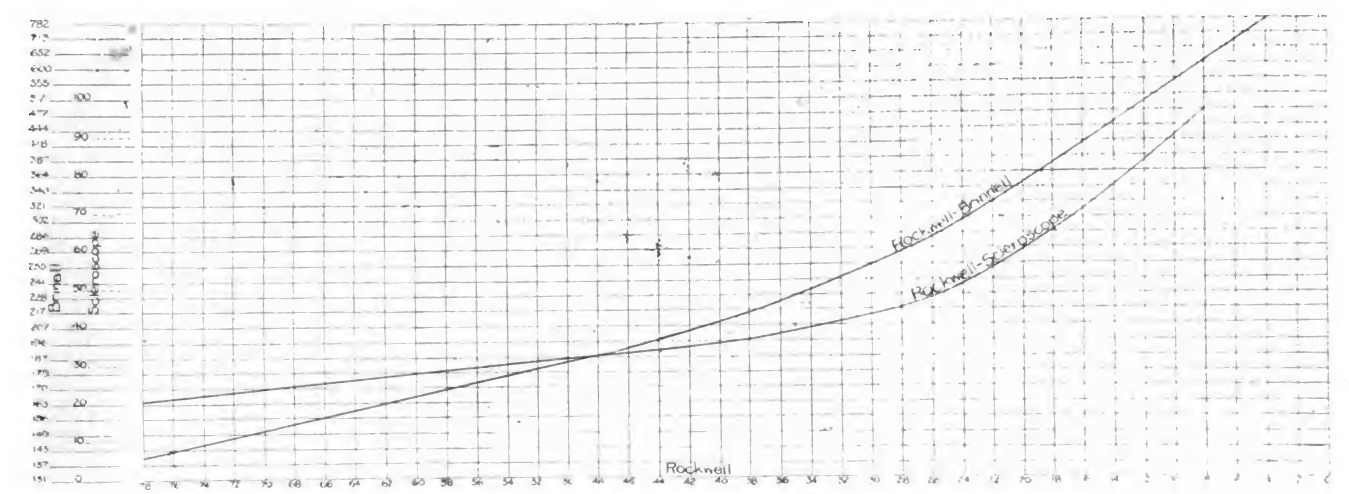

Fig. 4. Chart for converting Rockwell readings to Brinell or Scleroscope harness numbers

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Vol. LXII AUGUST, 1920 No. 4

For a Bureau of Aeronautics

IN the light of present agitation to keep out British airplanes and airplanes which according to the supposition are about to be dumped upon the American market at ridiculously low prices, attention is drawn to the fact that this would be a splendid problem to turn over to a Department of Aeronautics, if we had one at Washington. There was a bill before the Congress which recently adjourned without accomplishing much of anything, fathered by Congressman Hicks, and known for that reason as the Hicks aeronautic measure. This bill known within Congress as H. R. 14137, proposed the creation of a Bureau of Aeronautics in the Department of Commerce, to be presided over by a Commissioner of Aeronautics.

As the idea of this bill is simply to centralize all aeronautic work into the hands of a single department, with one responsible head, while leaving to the military and naval arms of the government the training in their own way, of their own personnel, it is well worth consideration. The passage of this measure by the new Congress would do much in the way of eliminating double effort, departments working at cross purposes, discouragement of initiative, waste of time and money, and the other evils of the present loose and haphazard methods.

According to this Hicks measure, the Aeronautic Board appointed by the President, would consist of two members each from the Aviation Corps of the Department of War, and the Bureau of Aeronautics of the Department of the Navy; one member each from the Department of the Treasury, the Post Office Department, the Department of the Interior, the Department of Commerce, and the National Advisory Committee for Aeronautics. This Aeronautic Board will have authority to consider and recommend to the heads of departments concerned on questions of policy, education, preliminary training, commercial production of aircraft, establishment, elimination and consolidation of all flying fields and air stations, and all other matters in which the several departments may be jointly interested. It will also have authority to assign all experimental work.

Although the board will have all programs for experimental research and development work submitted to it, the Army and the Navy will be free to prosecute independent experimental work in their respective services up to a cost of twenty-five thousand dollars. The board will also pass upon all types of aircraft, accessories and motors which are to be paid for with Government funds, before they are put into production. In a word the new board will coordinate and standardize practices, specifications, forms of contract and matters of design, production and operation.

A most important provision and a wise one is that the commissioning, enlisting, training, et cetera of the aviation personnel of the several departments of the Government and the operation and maintenance of their aircraft shall be left under the authority of the several departments.

The Bureau of Aeronautics is to foster, develop and promote all matters pertaining to civil or commercial aeronautics, is to maintain landing fields other than military and naval stations, including those used for private or commercial purposes. Another important function is the designation of aerial routes, in which work the Commissioner of Aeronautics is to cooperate with the various states, cities and municipalities. In the Post Office Department there is to be created a Division of Aerial Mail Service; but in regard to this department as in regard to those of War and the Navy, all programs for new construction are to be submitted to the Aeronautic Board and passed before contracts can be let. The board will draft rules for air navigation and traffic and will have under its jurisdiction the matter of issuing licenses.

As a compromise of conflicting views this bill should meet with general approval.

Making Some Progress in Aeronautics

COMPARISONS are odious but in the interests of aeronautics in this country it is only fair to say that the sudden action of the War and Navy Departments in cancelling all aircraft work as soon as the armistice was signed has stifled the industry, just as it was getting fairly started into other work. With some Government support to form a backbone plans for the future could have been worked out in an ambitious, far-sighted way, and an industry slowly built up which would have been a credit to the country, as well as a very big future asset.

By contrast with the far-reaching efforts of this decision, the action of the post office department is to be commended. In carrying mails, this department has found the airplane universally punctual and reliable, and based on two years of this service is now planning a country wide expansion of the service. The test trip from New York to the coast has been made, and bids are being asked for New York-Atlanta, Cleveland-Dertoit, Pittsburgh-St. Louis, Chicago-St. Louis, St. Louis-New Orleans, and other services. This will do much to help the very bad mail service, but it will do a great deal to revive the airplane industry, built up to such tremendous heights only to be dropped with a thud. If the country reaps tremendous benefits from this extension and speeding up of the mail service brought about by airplanes, it will have received a rich return, though belated, from the millions spent on aircraft during the war.

The Uses of Plywood in Automobile Body Construction

By ARMIN ELMENDORF*

Ways in Which Plywood Can Be Used in Building Automobile Bodies and Its Advantages for Each of These—Strength and Other Qualities

PLYWOOD has been used for many years as a material for such automobile body parts as roofs, dashes and instrument boards, but it was not until the end of the European war that the extent to which this material was used in automobile construction greatly increased. The explanation of this comparatively sudden demand lies in the improvements in the method of manufacture resulting from the requirements for war material. Prior to the European war practically the entire output of plywood used in automobile construction was glued with common non-water-resistant hide or vegetable glues. On account of the ever present danger of the separation of the plies glued with these glues when exposed to rain, its extensive use in automobile construction was never realized.

The sudden requirement of airplanes during the war created a large demand for plywood which would withstand the severest weather conditions. Glues were perfected that enabled the government to draw up specifications requiring that the plywood withstand 8 hr. of boiling or 10 days of soaking in water without separation of the plies. With the perfection of its water-resistant qualities the remaining highly desirable properties of plywood as a structural material for airplanes were made available In the construction of aircraft strength per unit of weight was the most important factor. In this respect plywood compared favorably with all other structural materials, including high grade steels. Large quantities were required particularly thin, flat sheets of large area for fuselage construction. Fuselage material must also show a minimum distortion or warping with changes in atmospheric conditions. It must possess high resistance to splitting, must not splinter, must be stiff, absorb rather than impart vibration, and it is necessary that it be moldable. Each of these requirements was fulfilled to a satisfactory degree by plywood.

It so happens that the properties of a material for many parts of an automobile must fulfil exactly the same requirements demand for airplanes. In order that the power consumption of the car may be kept at a minimum, the weight must be reduced. Materials used should therefore yield maximum strength per unit of weight. They must lend themselves to a good finish and be workable with conventional mechanics' tools. Plywood also fulfils each of these requirements.

Plywood An An Engineering Material

Much of the antagonism that existed in former years to plywood as a structural material can be attributed to the name commonly applied. The term "veneer" was quite generally used irrespective of the number of plies or of the details in the construction. This word carried with it an impression of concealment as if thin sheets of wood of a fine quality were glued over a base of poor material with the result that the defects in the latter were hidden. Frequent peeling of the face plies also contributed to a general disfavor of this material. In the terminology now being adopted by the industry, the word veneer refers to the individual sheets of thin wood, while plywood is used for the assembled glued-up stock. For automobile parts grain or appearance is usually a secondary consideration, the mechanical properties being of much greater importance. It is for this reason that plywood is now frequently spoken of as an engineering material. Like steel or concrete it has certain definite strength properties which, if they are known, can be used in engineering design. With the exception of its use in instrument boards, plywood is an engineering material in automobile construction. Similar to the plywood which was used in building airplanes, that which is now demanded by the automobile industry may be soaked or boiled in water for many hours without separation of the plies.

With the disappearance of the objections to plywood resulting from the perfection of this material during the war and the knowledge that it can be molded to conform to fuselage sides, the demand for plywood roofs rose. Several large automobile companies now favor this material to the exclusion of all others for the roofs of their closed cars. It is also being extensively used for cab roofs. Three-ply wood of a total thickness of about 5/16 in. is in common use. Panels for roofs have a core or center ply that is usually between two and three times the thickness of the face plies.

In addition to its use for roofs plywood is extensively used for the following automobile parts:

Dash boards
Instruments
Door linings
Window frames

Plywood is not applied as yet very extensively to the construction of automobile bodies and disk wheels. The difficulty that must be overcome before plywood can be very widely used for automobile bodies lies in the fact that it cannot be bent in severe double curvature. It cannot be molded to the form of most standard bodies.

The weight of the conventional plywood disk wheel has militated against its extensive use for wheels, but by proper design the weight can be materially reduced so that the advantage of great strength per unit of weight can also soon be realized in wheels.

Plywood Compared With Ordinary Boards

Wood, as is well known, is a non-homogeneous material, that is, its strength properties are different in different directions. Parallel to the grain the tensile or pulling strength of a board may be as high as 20,000 lb. per sq. in., while at right angles or across the grain the tensile strength may be only 1,000 lb., that is, in the former direction the tensile strength may be twenty times as high as in the latter direction. Practically the same ratio exists for the stiffness or modulus of elasticity in these two directions, that parallel to the grain may be 2,000,000 lb. per sq. in., while at right angles to the grain it may be only 100,000 lb.

*Consulting engineer, Haskelite Mfg. Corp., Chicago. Paper read before Cleveland Section of Society of Automotive Engineers.

In all standard plywood construction the grain of one-ply crosses that of the adjacent plies at right angle. With this distribution of the wood fibers a very marked increase in the strength across the face grain of a board is obtained. By a proper selection of the thickness of the center ply the strength across the grain of the face of three-ply wood is readily made equal to that parallel to the face grain. To obtain equal tensile strengths the thickness of the core of three-ply wood is made equal to one-half the total thickness of the panel. For equal bending strength the core thickness shoudl be about two-thirds of the total thickness.

The results of extensive tests made by the United States Forest Service at the Forest Products Laboratory, Madison, Wis., on the mechanical properties of plywood are given in Table 1. The strength values listed in this table are for three-ply wood in which all plies of a given panel are of the same thickness and of the same species, the grain of the successive plies running at right angles. In most cases eight thicknesses of plywood ranging from 1/10 to 3/16 in. were tested. In some of the species listed the tests were limited in number. Since a marked variation in the strength of the wood is shown, further tests on additional material would be expected according to the laboratory officials, to modify the values appreciably in some cases. The weight of plywood made of any of the species listed can be computed from the specific gravities tabulated in the first column. It will be seen that the kell known relation between strength and weight for ordinary wood also holds for plywood, that is, the strength in bending or in tension increases rapidly with increase in the weight. The column bending modulus is a measure of the strength in bending and can be used in computations similar to those invovling the modulus of rupture of ordinary wood. It must also be remembered that the strength is greatly affected by the moisture content, increasing with reduction in moisture content.

On account of the great influence of the moisture content of wood on its properties, the factors which influence the moisture content should be understood. It is, for example, not always necessary to submerge wood in water to increase its moisture, nor will mere exposure to high temperatures necessarily reduce the moisture content. By exposing wood to relatively high atmospheric humidity its moisture content can be increased, while exposure to low humidities such as in an arid country may

TABLE 1.—STRENGTH OF VARIOUS SPECIES OF THREE-PLY PANELS.

Species	Average Specific Gravity of Plywood Based on Oven-Dry Weight and Volume at Test	Average Moisture, per cent	Column Bending						Tensile Strength				Splitting Resistance	
			Column-bending Modulus				Modulus of Elasticity, 1000 lb. per sq. in.		Parallel		Perpendicular			
			Parallel[1]		Perpendicular[1]									
			No. of tests	Lb. per sq. in.	No. of tests	Lb. per sq. in.	Parallel	Perpendicular	No. of tests	Lb. per sq. in.	No. of tests	Lb. per sq. in.	No. of tests	Per cent of Birch[2]
Ash, black	0.49	9.1	120	7,760	120	1,770	1,070	96	120	6,180	120	3,940	210	78
Ash, commercial white	0.60	10.2	200	9,930	200	2,620	1,420	143	200	6,510	200	4,350	400	71
Basswood	0.42	9.2	200	7,120	200	1,670	1,210	85	200	6,880	200	4,300	400	83
Beech	0.67	8.6	120	15,390	120	2,950	2,150	167	120	13,000	120	7,290	240	94
Birch, yellow	0.67	8.5	195	16,000	200	3,200	2,260	197	200	13,210	200	7,700	400	100
Cedar, Spanish	0.41	13.3	115	6,460	115	1,480	1,030	84	115	5,200	115	3,340	230	60
Cherry[3]	0.56	9.1	115	12,260	115	2,620	1,630	152	115	8,460	115	5,920	230	89
Chestnut	0.42	11.7	40	5,160	40	1,110	740	75	40	4,430	40	2,600	80	74
Cottonwood[4,5]	0.46	8.8	120	8,460	120	1,870	1,440	109	120	7,280	120	4,240	240	85
Cypress, bald	0.45	8.0	113	8,890	113	1,850	1,220	95	113	6,160	113	3,980	148	49
Douglas fir[6]	0.48	8.6	176	9,340	200	1,940	1,530	126	200	6,188	200	3,910	374	63
Elm, cork	0.62	9.4	65	12,710	65	2,500	1,980	136	65	8,440	65	5,500	130	99
Elm, white	0.52	8.9	160	8,680	160	1,970	1,220	109	160	5,860	160	3,900	320	75
Fir, true[7]	0.40	8.5	24	9,200	24	1,811	1,580	100	24	5,670	24	3,770	48	60
Gum[8]	0.54	10.6	40	8,090	40	1,920	1,280	113	35	6,960	35	4,320	70	55
Gum, cotton	0.50	10.3	80	7,760	80	1,580	1,300	111	80	6,260	80	3,760	160	60
Gum, red	0.54	8.7	182	9,970	182	2,070	1,590	120	182	7,850	182	4,930	364	80
Hackberry	0.54	10.2	80	8,100	80	1,880	1,150	99	80	6,920	80	4,020	160	84
Hemlock, Western	0.47	9.7	119	9,250	119	1,960	1,580	112	119	6,800	119	4,580	238	63
Magnolia[9]	0.58	8.8	80	10,830	80	2,600	1,700	138	80	9,220	80	5,730	120	85
Mahogany, African[10]	0.52	12.7	20	8,070	20	2,600	1,260	144	20	5,370	20	3,770		
Mahogany, Philippine[11]	0.53	10.7	25	10,160	25	2,310	1,820	169	25	10,670	25	5,990	50	90
Mahogany, true	0.48	11.4	35	8,500	35	1,940	1,250	117	35	6,390	35	3,780		
Maple, soft[12]	0.57	8.9	120	11,540	120	2,420	1,750	145	120	8,180	120	5,380	240	106
Maple, hard[13]	0.68	8.0	202	15,600	202	3,340	2,110	189	192	10,190	202	6,530	404	114
Oak, commercial red	0.59	9.3	115	8,500	115	2,070	1,290	120	115	5,480	115	3,610	230	70
Oak, commercial white	0.64	9.5	195	10,490	195	2,310	1,340	118	195	6,730	195	4,290	390	85
Pine, sugar	0.42	9.4	65	8,050	70	1,670	1,310	90	70	5,430	70	3,690	140	43
Pine, white	0.42	5.4	40	10,130	40	2,050	1,570	111	40	5,720	40	3,340	80	31
Poplar, yellow	0.50	9.4	165	8,860	165	1,920	1,540	115	155	7,390	165	4,720	330	51
Redwood	0.42	9.7	105	8,230	105	1,550	1,180	108	105	4,770	105	2,960	210	48
Spruce, Sitka	0.42	8.3	121	7,710	121	1,690	1,370	105	121	5,650	121	3,410	224	78
Sycamore	0.56	9.2	163	11,040	163	2,340	1,650	130	163	8,030	163	5,220	326	77
Walnut, black	0.55	9.1	110	12,660	110	2,770	1,740	141	110	8,250	110	5,260	220	77
Yucca species	0.49	7.3	33	2,960	33	900	560	44	33	2,210	33	1,700	66	14

[1]Parallel and perpendicular refer to the direction of the grain of the faces relative to the direction of the application of the force.
[2]The relative splitting resistance of the various panels tested depends largely on the holding strength of glue.
[3]Probably black cherry.
[4]Probably common cottonwood.
[5]Coast type.
[6]Probably white fir.
[7]Probably black gum.
[8]Probably (Evergreen) magnolia.
[9]Probably Khaya species.
[10]Probably tanguile.
[11]Probably silver maple.
[12]Sugar or black maple.

greatly lower the moisture content. It is a common observation that the moisture content of the wood in a room kept at 70 deg. F in winter is much lower than that of the same piece of wood in summer when it is exposed to the free circulation of air at the same temperature. The relation between the relative atmospheric humidity and the percentage of moisture contained by wood is quite definite and is practically the same for many species. This relation is shown in the curve of Fig. 1.

The importance of a knowledge of the factors affecting the moisture content of the wood lies in the fact that wood will shrink or expand with any change in the moisture content. Such shrinkage takes place across the grain and is greater for boards cut tangentially from a log than for quarter-sawed boards. The shrinkage with the reduction in moisture content in a direction parallel to the grain is negligibl.e On account of the great stiffness of wood parallel to the fibers and its low shrinkage in this direction, the shrinkage of plywood resulting from a reduction in moisture content is very low. It is in fact only about as great as the shrinkage parallel to the grain of any ordinary wood. Where a board may be reduced in width by .2 in. the corresponding reduction in width of plywood will only be about .01 in. It is this marked difference in shrinkage between plywood and ordinary wood that makes it a superior material of construction for many purposes. Least possible shrinkage is desirable in automobile panels because an automobile may be exposed to extremes in atmospheric humidity and consequently the moisture content of the wood or plywood will undergo appreciable changes. Shrinkage may either cause checking of the panel which would mar the finish or it may cause loose joints, thereby introducing irritating noises in driving or even materially reducing the strength of the joint.

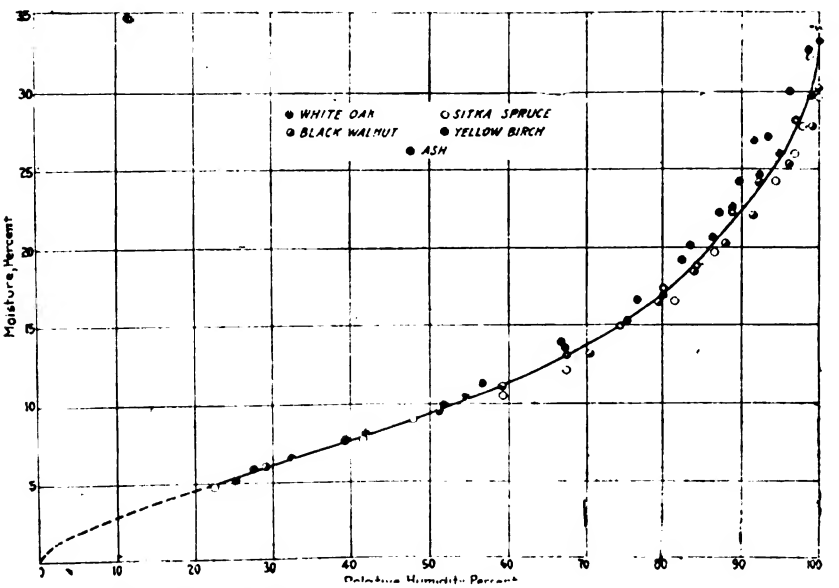

Fig. 1. Chart showing relation of atmospheric humidity and moisture content of wood

In connection with the shrinkage of wood or plywood it should be borne in mind that no paint, varnish or enamel, irrespective of its advertised waterproof qualities, will prevent changes in moisture content of the wood it protects if the exposure to extreme humidities extends over a long period of time. Tests have shown that only a metallic coating like aluminum leaf is strictly impervious to moisture penetraiton.

One of the properties of ordinary wood that greatly limits its use for many purposes is its low resistance to forces tending to split the board. This is of course due to the relatively low strength of wood across the grain. By laminating and crossing the grain of successive laminations as in plywood this property is materially improved. The great resistance to splitting possessed by plywood is graphically illustrated in Fig. 2 (omitted). The nails in the corners of the small panels were driven into the plain surface of the wood without any preliminary drilling. The sections are 5/16 in. thick. Even the largest nails caused no splitting of the plywood.

The machine shown in Fig. 3 (omitted) was built at the Forest Products Laboratory to determine the relative resistance to splitting of plywood made of various species, thicknesses and combinations of plies. A test-specimen is shown suspended at the tip of the tool-steel spear. The height to which this spear was raised and allowed to fall is progressively increased until fracture by splitting takes place. The test-specimens shown in Fig. 4 were ruptured in this way. The height of drop at which failure takes place is recorded at a measure of ability of the specimen to resist splitting.

Questions are frequently asked regarding the ability of plywood to resist vibration. This property is of considerable importance in both automobiles and airplanes. Tests made at the research laboratores of the company with which I am associated have shown that plywood can be subjected to vibrations severe enough to cause weakening of the wood and yet no failure in the glue joint will take place. Specimens were subjected to several million repetitions of stress until an actual reduction in the strength of the wood seemed to have taken place. It will be remembered that wood, like other structural materials, particularly steel, will fail under repeated stresses that are much below those which cause failure in slow or static loading. The tests were limited to plywood made by the company mentioned and the conclusions have still to be verified for various water-resistant glues.

Extensive shear tests made at the Forest Products Laboratory on plywood of different constructions have shown that while the initial failure occurs at a stress only slightly greater than the shear strength of ordinary wood, final or complete failure in shear is difficult to obtain on account of the tendency of the fibers to hold on in tension. The failure of ordinary wood in shear is sudden and complete, while that of plywood is progressive and prolonged. This property is somewhat analogous to the characteristic of steel described as toughness. A brittle metal will snap while a ductile or tough metal will yield and yet on account of the stretching imparted to it show no failure. Its ductility makes it a superior steel for many purposes. Plywood which is much tougher in shear than ordinary wood is likewise superior to wood.

Plywood Compared with Metals and Pulp Boards

In comparing the tensile strength of plywood with other materials used for automobiles such as pulp board, aluminum and steel, red gum was selected as a species because it is very extensively used in automobile construction and is of medium density and strength. The strength values given for this material in Table 2 were taken from the

Table 2—Strength of Automobile Materials

	Specific Gravity	Tensile strength lb. per sq. in. Parallel to grain	Perpendicular to grain	Average	Tensile strength per unit of weight lb. per sq. in.
Three-ply wood..	.59	7850	4930	6390	10800
Pulp board.....	.64	1946	902	1424	2230
Rolled aluminum.	2.70	....	....	19450	7200
Mild steel.....	7.85	....	....	60000	7650

Forest Products Laboratory figures listed in Table 1. The specific gravity given in the latter table is for over-dry weight. A moisture content of 9 per cent was assumed, which brings the specific gravity up to .59. It will be seen that the strength per unit of weight of the plywood is superior to that of the pulp board aluminum or steel.

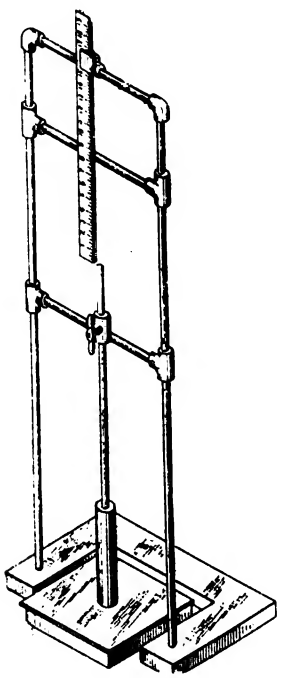

Fig. 5. Device used in impact tests of plywood and other sheets

In addition to strength, an automobile material, especially if it is exposed in a large surface, must resist impact. If the surface is struck, it should show a minimum tendency toward receiving a permanent impression. Tests were made at our laboratories to compare the resistance to impact of steel and aluminum sheets of the usual thickness used in automobile bodies with three-ply wood of about the same weight. The device illustrate in Fig. 5 was designed for this purpose. A panel was placed upon the surface of a frame 10½ in. square on the inside and a plunger weighing about 12½ lb. was allowed to drop from increasing heights upon the surface of this panel. The results of such impact blows upon panels of steel, aluminum and three ply red gum are shown in Fig. 6. It is apparent that the permanent set in the metal panels is very large, while with the exception of a slight dent in in the outer surface, no permanent deformation was caused in the plywood panel. The results of the test are given in Table 3. It will be seen that the energy imparted to the plywood panels was many times as great as that to the metal sheets. Whereas only one blow was necessary to produce a large dent in the metal sheets, the plywood was subjected to several drops of equal height and even then suffered no serious set or fracture. Under these severe conditions the plywood showed no further injury than slight surface depressions.

The results of slow static loading upon panels of plywood, steel, and aluminum of the same size are shown in Fig. 7. It will be seen that the load at which a material yielded or suffered a permanent set was very much higher for the plywood in both cases. The plywood was also stiffer as indicated by the slope of the curve.

Many erroneous ideas are current pertaining to the construction of plywood, which frequently result in creating an unfavorable impression of plywood as a material of construction. One airplane manuaftcrer for example was under the impression that to gain equal strength in the two directions parallel and perpendicular to the face grain, it was best to use four plies each of the same thickness running two in one direction and two at right angles to it. Experience has shown and an analysis of the

Table 3—Impace Tests on Automobile Materials

Material	lb. per sq. ft. Weight,	blows,ft.-lb. Energy of
Aluminum	.91	16
Steel	1.21	16
Three-ply Haskelite.....	.91	78
Five-ply Haskelite.....	1.16	151

stresses introduced bears out, that such a construction of plywood must introduce considerable warping when undergoing moisture changes. The following rule may be adopted to govern the proper construction of plywood so as to minimize all tendency to warp.

A panel must be made of an odd number of plies and for every ply on one side of the center there must be a corresponding ply on the opposite side at the same distance from the center, of the same thicknes, and of the same species or one of about the same density, and having its grain running parallel to that of the first ply. The grain of successive plies should always cross at approximately 90 deg.

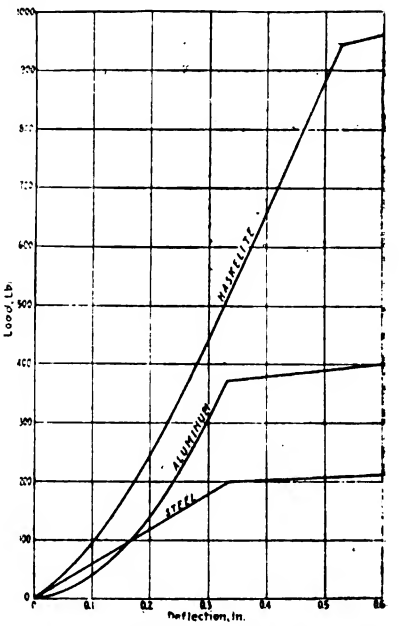

Fig. 7. Chart indicating results of static loading on panels of plywood and other sheets

Even small deviations of this rule may cause warping in the case of large thin panels.

In making a selection of species it is usually only necessary to examine the density of the species to obtain information in regard to its properties. Hardness, strength and stiffness are increased with increase in density.

Molding Plywood

The remarkable degree to which three-ply wood can be bent is illustrated in Fig. 8 (omitted). The strips shown were originally flat. They were placed in boiling water for several hours until the wood fibers were thoroughly softened, then bent over a form and clamped in position until they were dry. Upon removing the clamp it was found that the specimen had assumed and retatined the curvature of the form. The specimens were 5/16 in. thick and were bent with the face grain extending around the bend. Bending in simple curvature, as shown in the specimens of this figure, is a comparatively simple procedure.

It is when an attempt is made to bend plywood in compound curvature that great difficulty is experienced. In cases of this kind the wood must be upset. The meaning of this term is best understood by examination of the changes that take place in bending a wood felloe for a wagon wheel. The wood strip intended for this purpose

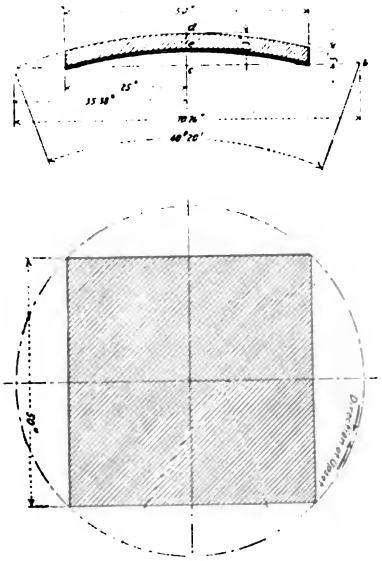

Fig. 9. Spherical surface similar to truck cab roof indicating direction of upsetting

is first softened by steaming and then bent around a form. Careful measurements have shown that the wood fibers on the circumference or outside circle suffer no elongation and that the change in the dimension all takes place due to a shortening of the other fibers. The magnitude of the shortening or upset of the wood fibers on the inner circumference is given by the difference in the length of this circumference and the outer circumference. This difference expressed in per-

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Only in the case of compound curvature however must any appreciable upset be given to the material. This will be understood by referring to the diagram in Fig. 9. It will be assumed that a flat circular panel is available having a diameter equal to the arc adb. It will also be assumed that the panel is made of a material that is plastic in the sense that it can be upset but cannot be stretched. To make it conform to the spherical surface, its circumference will have to be shortened by a magnitude equal to the difference in the circumference of the two circles whose diameters are the chord acb and the arc adb. When this difference is expressed in percentage of the original length, it will be seen that for the particular spherical surface of Fig. 9, the fibers along the edge will suffer an upset of 1.5 per cent. A square section 50 in. on edge will be cut out of this spherical surface. The section illustrated conforms to the requirements of a typical motor truck cab roof. The fibers near the corners are consequently upset 1.5 per cent. The magnitude of the upset at other points can be computed in a similar manner. The computation of upset for roofs of closed passenger cars is more difficult and complicated.

The advantage accruing from bending plywood to double curvature is well illustrated in Fig. 10 (omitted) which shows in elevation a typical sedan roof made of plywood. Such a roof has supported the weight of five men without suffering any injury. To bend plywood to conform to the curvatures required in automobile roofs, it is necessary first to soften the fibers by wetting or steaming and then to press the flat three-ply panel in suitable dies. Means must be provided for drying the wood because it is only when the fibers are dried in the dies that the upset remains permanently.

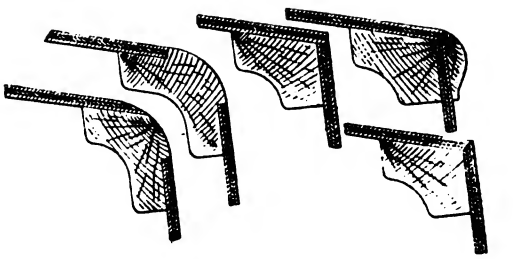

Fig. 11. Typical roof construction using plywood

Plywood can be fastened to the roof frame in various ways. Typical constructions are shown in Fig. 11. Of these the method illustrated at the left is probably the most common. Some manufacturers prefer to cover the joint with cloth to eliminate any possible showing of the joint.

The molding of plywood to compound curvature lends itself to many industrial applications. The magnitude of the upsetting that can be attained is however limited. Such curvatures as those in the cowling of an automobile cannot be made of plywood. Extreme warped surfaces must continue to be made of steel or aluminum. In the present trend in design many of the compound curvatures in both body and roof can however be made of plywood.

American Trucks Successful in Shanghai

A fleet of twenty-five American motor trucks is engaged in transporting merchandise within the city of Shanghai. It is the first public motor truck service to be establish in China and is conducted by the China Garage Company of Shanghai, which started this improved system of transportation last August. The plan at first aroused considerable opposition, according to a recent number of the Oriental Motor, from the owners of wheelbarrows and string carts, on the ground that the coolies operating those simpler vehicles used for so many years in China would be thrown out of employment.

The manager of the truck service disposed of this argument by stating that at present there are 3,000 string carts in Shanghai and that it would require about 1,000 trucks to perform the service they are engaged in. Each of the trucks in use carries four coolies and to promote efficiency a bonus is paid according to the number of trips made by the truck daily.

A Method of Rust Prevention

For obvious reasons shock absorbers and springs on automobiles should not be allowed to rust.

It is easily prevented if the car owner will keep on hand a small can of fender enamel with which to touch up bare spots as soon as they make their appearance. Of course it looks better to apply a coat to the whole spring or shock absorber, but this is only necessary for appearance sake; so far as preventing rust is concerned covering the bare spots as they develop will answer all practical purposes.

A jitney service of 60 cars is about to be started in Batavia, Java, replacing the gharries and dogcarts.

Great Increase in Manchurian Demand for Paints

The erection of new buildings in connection with the development of South Manchuria should increase the importations of paints, oils, and varnishes which have amounted to about $1,000,000 annually, approximately 60 per cent of which was used by the South Manchurian Railway Co. Prior to the war British and American paints dominated this market, but as it became more difficult to obtain the desired brands because of the lack of shipping facilities those of Japanese manufacture became better known.

With the return of normal conditions the potentialities of this market have become greater, providing American makes can compete with the prevailing prices as their superior quality is recognized. One of the brands now in demand is an ordinary lead paint, packed in drums of 28 and 112 pounds, the former selling at $2.50 and the latter at $4.50. Mixed paints put up in 1 pound tins sell wholesale at $1.50 per dozen tins. Enamels which are now in great demand, wholesale at $3.50 per dozen tins of one-half pound each. Varnish is selling at $4.20 per dozen tins of 2 pounds each.

There are two kinds of paint oil on the market, one reported to be of pre-war stock is put up in 4 gal. drums selling at $7 per drum wholesale, and the other, a Japanese product, put up in 36 pound drums selling at $4 per drum wholesale. Turpentine, principally of Norwegian origin, comes to this market via Shanghai, the wholesale price being $11 per 4 gal. drum. The above prices were those ruling about the first of May.

Oil Situation Much Improved

In addition to the recent great improvement in the gasoline stock situation, it appears from the latest reports of the U. S. States Geological Survey, covering the month of June, that the whole oil situation is improved.

The production of crude oil exceeded consumption for the first time in almost a year, totaling 37,219,000 bbls. against a consumption of 35,234,000 bbls. Not alone was this monthly total a new high record but the daily average of 1,240,633 bbls. was also a new high mark. Aided by a decrease of practically two million in consumption and the increase of 288,000 bbls. in production, as well as by larger imports, the storage totals were increased to 126,674,000 bbls., the first time this has exceeded 125 million since February last. Imports, almost entirely from Mexico, exceeded exports, largely to Mexico, by 7,549,202 bbls., a very large increase and a new high record in total as well as in daily average. This brings the six months total to practically 36,000,000 or at a rate of 75,000,000 for the full year. Incidentally it should be noted that the percentage of light Mexican oil which contains the largest percentage of motor fuel, has gradually risen until the figure for June is 50 per cent, the other half being almost equally divided between heavy and topped oils.

Petroleum Institute Suggests Fuel Remedies

In a report on the general petroleum situation, R. L. Welch, secretary and counsel of the American Petroleum Institute, of which the leading oil producers and manufacturers are members, after giving a general outline of the situation, sums up as follows:

"In 1919 we consumed 375,000,000 bbls. of crude oil. Since the first of August, 1919, and down to the first of March, 1920, we have been consuming at the rate of 436,000,000 bbls. per annum, and we have been producing at the rate of 402,000,000 bbls. per annum. This shows an excess of consumption over production of 34,000,000 bbls.

"The remedy for the present fuel shortage lies in the following:

"First, the government of the United States must cooperate with the oil business and with the automotive industry at home and abroad if the gasoline problem is to be solved.

"Second, the greatest possible efficiency must be gotten by the automotive industry and by the consumer from motor fuel or the problem will not be solved.

"Third, the oil industry must be more efficient and must get more gasoline from each barrel of crude.

"With reference to the second remedy, the efficiency of the products of the automotive industry, there is need to curb the present demand for cars developing 70 to 80 horsepower but which are operated generally at 20 miles an hour or less."

Chicago City Engineer Favors Trailers

Amendments to the traffic ordinance in Chicago have been drafted to be submitted to the city council with a view to preventing rapid destruction of the street pavements by excessively heavy traffic. The proposed changes were discussed at a recent meeting in the office of the city engineer Mr. Combs, who is chairman of the special traffic commission charged with drafting the amendments. It is proposed to change the gross weight of vehicles and load from 40,000 pounds as at present allowed, to 30,000 pounds, with a maximum weight of 1,000 pounds per inch width of tire, but it was agreed at the meeting that the combination of a truck and semi-trailer with load should be allowed a weight of 32,000 pounds with a limit of 24,000 pounds on any one axle.

During the meeting the city engineer said he was very much in favor of the use of trailers and felt it was preferable to have loads spread over the six or eight wheels of a truck and trailer or semi-trailer rather than to have the weight concentrated on the four wheels of a truck carrying the load alone.

Federal Trade Commission Says No Profiteering in Oil

In the decision of the Federal Trade Commission given out June 1 relative to its investigation of the petroleum interests and in particular the recent price increases, the Commission ruled that the industry was justified in raising its prices as a result of the excessive demand for its products. The Commission found itself unable to state that profits had been excessive or even large in petroleum products.

It recommended the development of oil fields in other countries and restriction of exports, also less wasteful methods of drilling and refining.

At the decennial celebration of the Forest Products Laboratory held at Madison, Wis., July 22-23, C. F. Kettering, chief engineer, General Motors Co., and former president Society of Automotive Engineers, spoke on "What Research Has Accomplished for the Automotive Industry."

Drying Periods of Various Woods

Conservative figures to use in estimating the kiln output possible with various woods are given in the following table prepared by the Forest Products Laboratory. Drying time as here given is not limited by the type of kiln but by the physical behavior of the wood. Any dry kiln in which the circulation is adequate and the temperature and humidity are properly controlled should produce in the time specified material of high quality, free from visible degrade, if not quite equal in strength properties to air seasoned stock.

Approximate time required to kiln dry, under mild conditions, one inch plain sawed green and partially air dry stock to moisture content of six per cent, based on weight or dry wood:

Species	Days drying time: Green from the saw	Partially air dry 25 per cent moisture content
Hardwoods		
Swamp oak	45 to 40	20 to 25
Northern oak	30 to 40	17 to 20
Walnut, cherry	22 to 30	13 to 15
Mahogany, beech	16 to 22	9 to 12
Tupelo, gum	20 to 26	10 to 14
Birch, ash, sycamore	15 to 21	9 to 12
Poplar, basswood, chestnut butternut, elm, cherry.	8 to 10	4 to 6
Maple, hickory	17 to 23	9 to 13
Conifers		
Western larch	9 to 12	4 to 6
Cypress, redwood	10 to 18	6 to 8
Douglas fir, yellow pine, incense cedar, spruce..	4 to 6	3 to 4

For stock over 1 in. and not more than 3 in. thick the drying time is proportional to the thickness. For example, 3 in. stock requires 3 times as long to dry as 1 in. stock. Quarter sawed stock requires from 25 to 35 per cent more time to dry than plain sawed. Drying to 10 or 14 per cent moisture content takes from one-fourth to one-third less time than drying to 6 per cent.

Elimination of Cutouts Recommended by N. A. C. C.

On recommendation of the Motor Truck Committee of the National Automobile Chamber of Commerce the following resolution was introduced and unanimously adopted at the general meeting of motor truck members, held at New York on June 3. "Whereas, the use of muffler cutouts on motor trucks is highly objectionable to the public, and

"Whereas, they are no longer deemed necessary in the construction and proper operation of motor trucks,

"Therefore, be it resolved, that the chamber recommends and suggests that cutouts on motor trucks be eliminated."

To Distinguish Mahogany and Walnut From Red Gum

In the manufacture of automobile bodies and cabinets a great deal of red gum is used as an imitation of mahogany or Circassian walnut. When red gum is properly finished it can be made to look so much like either of these woods that only by very careful observation can the true be distinguished from the substitute. There is a very distinct difference however between red gum and mahogany or walnut. This difference lies in the size of the pores.

In mahogany, Circassian walnut and black walnut the pores are so large that they can be seen very distinctly on a smoothly cut surface of the end grain, where they appear as minute openings smaller than pin holes but visible without magnification. On surfaced faces the pores appear as fine grooves, running parallel with the grain. They are even visible through the varnish, appearing as dark lines.

In red gum the pores are much smaller and can be seen only with a magnifying glass.

Stout Batwing Type of Airplane

The Stout Batwing monoplane is a giant wing in which are accommodated machinery, trussing, etc. The engines are set into the leading edge, the passengers are enclosed between the surfaces of the wing section, and every part that is exposed to the air is designed to lift.

The central part of the wing is thick and of long chord, the tip thin and narrow. In fact, the ship follows more closely the butterfly than the bird in its plan view, and gives more surface within smaller dimensions.

An experimental machine was first flown at Dayton in the spring of 1918 and this machine used for research and development work toward later models. At present several commercial types of ships are being designed or are on the way, and some enormous planes intended for military use.

The thick main wing is not only framed up entirely of veneer, but the surface as well is formed of this extremely tough and waterproof material. The veneer on the surface is three-ply and only 1/20 in. thick. The wings are strong enough however so that one can walk all over them as a sidewalk.

The radiators in this ship pull into the wings when high altitudes are reached, and the heat from them is utilized to warm the passengers and pilot. In the large type even the landing gear is pulled into the wing when the ship is off the ground, increasing its speed by about 10 m.p.h.

A new ship of this type being laid down has a span of 100 ft., and a wing depth of 7 ft. at the center. It has within it a compartment for mail, bombs or passengers as the case may be, this cabin being 30 ft. long, 6 ft. high and 8 ft. wide.

The importation to the United States of 10 foreign cars in February, 1920 (valued at $21,341) brings the total for eight months to 107. Last year in the same period, it was but 57. and the year before, 35.

New Hardness Testing Machine

Concluded from page 21

The standard equipment with each model includes two testing points, one indicating dial calibrated in hundredths of a millimeter from zero to 100, dash pot, two standard steel samples for calibration, four chucks for holding various work, and a set of directions. If desired indicating dials marked in Brinell or Scleroscope hardness numbers can be had as an extra, although the chart, Fig. 4, gives this readily. Other extras include operating attachments to operate the final weights, and extra testing points.

Helpful Hints for Designers and Draftsmen

Molybdenum Steels Important Factors in Liberty Motors

One of the surprising results brought about by the war was the actual proof of the beneficial results on steel long claimed for small molybdenum contents. The steels containing this element included chome-molybdenum, chrome-nickel-molybdenum, chrome-vanadium-molybdenum, nickelmolybdenum and others.

As there is no part of an internal combustion motor more important than the crankshaft, it is interesting to note what beneficial results the use of this new element had on crankshaft steels.

Of the three grades of chrome-molybdenum steels the one of medium carbon content is probably the most important when considered purely from the standpoint of tonnage. It is a water-hardening forging steel used for airplane, automobile, truck and tractor parts such as crankshafts, connecting rods, steering knuckles, steering levers, front axles, etc., rear axle drive shafts, propeller shafts, either heat treated or cold drawn; automatic machinery parts, spindles, bolts, etc. Tests on approximately 4,000 finished crankshafts forged from this type, showed the following average properties:

Carbon	Manganese	Chromium	Silicon	Molybdenum
0.25—0.32	0.71—0.76	0.45—1.04	0.11—0.22	0.32—0.46

(On finished crankshaft)

Elastic Limit	Tensile Strength	Elongation Per cent	Red of Area Per cent	Brinell Hardness
131700	149900	17.7	61.8	304

Considering all factors, physical and economic, entering into the manufacture of springs, several large producers have already gone on record as pronouncing this type the best commercial spring steel thus far developed. Its properties are as follows:

Molybdenum—0.25 to 0.40 per cent

Carbon	Manganese	Silicon	Chromium
0.40—0.50*	0.60—0.90	0.10—0.20	0.80—1.10

*Down to 0.35 for forgings. Up to 0.60 for rivet sets, etc.

Elastic Limit	Tensile Strength	Elongation Per cent	Red of Area Per cent
180000	200000	12	37
to	to	to	to
210000	230000	15	45

This steel is in use on the Fifth Avenue buses of New York. Gears made from this type of molybdenum steel combine a high degree of hardness and resistanace to wear, with greater strength and toughness. Less warpage, greater depth of penetration of the hardening and better machining qualities for given strength in the annealed condition, characterize this type of gear steel.

The steel which stood out pre-eminently as one of the metallurgical achievements of the war was the chrome-nickel molybdenum steel, which toward the close of hostilities was playing an ever-increasing part in the successful quantity production of the Liberty motor. Dynamic and physical properties coupled with exceptional machining qualities, characterize this product. The practical elimination of straightening operations during manufacture, due to minimum warpage, the permissible cutting speed during machining, the wide temperature range allowable in heat treatment, the uniformity of results, the fine "finish" developed and the smaller effect of section, are some of the reasons for the adoption of this type of steel in the industries of peace.

The actual results on the finished Liberty motor crankshafts, as furnished by the courtesy of the United Alloy Steel Corp., Canton, O., averaged as follows.

C.	Mn.	Si.	Cr.	Ni.	Mo.
0.305	0.69	0.52	0.98	3.05	0.54
0.236	0.50	0.08	0.74	2.85	0.32

Elastic Limit	Ultimate Strength	Elongation Per cent	Red. of Area Per cent	Izod	Brinell
130000	142000	20.5	65.0	67	303

The crankshafts were treated as follows: Forged and then twisted through the required angle; shaft is then annealed at 1,600-1,650 deg. F to relieve strains. Time at heat is about 1½ hr. Cooled in air. Heated in an electric furnace to 1,475 deg. F, held ½ hr. and quenched in water. Drawn at 1,150 for 2 hr. Cooled in air and straightened before the temperature has reached 800 deg. F.

Testing and Various Stress-Testing Machines

To get the best from actual steel or any other material it must be tested to prove what the quality of the material was in the first place, and to check this with the quality which the designer intended to be in that particular part. This makes testing of supreme importance, and the machines used for this purpose as well. According to the National Research Council, speaking with reference to fatigue phenomena in metals, metal parts of machines such as springs, shafts, crankpins and axles, occasionally fail suddenly while only subjected to conditions of ordinary service. Not only does failure occur suddenly, but the part about to fail shows no ordinary evidence of weakness. The broken parts when examined are seen to be broken off short, and without general distortion, even though the material may show ductility in ordinary tests. The phenomena which are involved in the final failure of metal through oft-repeated loading is generally known as "fatigue."

The phenomena of fatigue failure have recently given rise to some perplexing problems in connection with the design and service of aeroplane-engine crankshafts, the hulls of steel ships, axles and shafts in railway cars, motor cars and trucks, and other machine parts. The question whether structural parts subjected to repeated stress are in danger of fatigue failure has been discussed at considerable length. The danger of fatigue failure seems to be an unimportant factor in determining the safety of structural parts, with the possible exception of parts subjected to reversal of stress. The reason for this is probably found in the relatively small

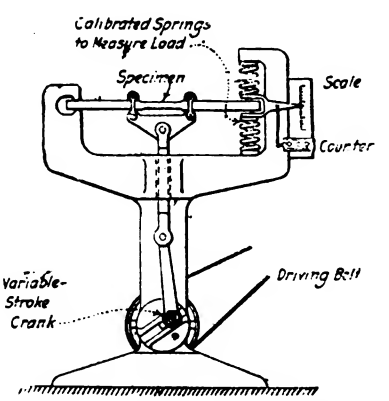

Fig. 1. Type of repeated stress testing machine

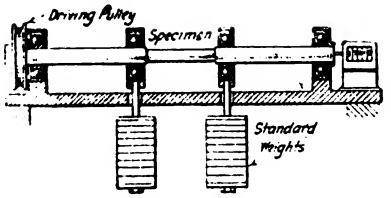

Fig. 2. Type to determine reversed bending stresses

number of loadings which most structures are called upon to withstand, and in the fact that most of the loadings are below the maximum safe working value. On the other hand, the danger of fatigue failure is a major factor in determining the safety of many machine parts.

Fatigue tests cannot readily be carried out with ordinary "static" tensile testing machines. It is of course possible to make repeat loadings on a test specimen in such a machine, but the progress is very slow. Such a machine equipped with an ingenious automatic arrangement for applying and releasing load was used by Van Ornum in fatigue tests of concrete in compression, but the time required for even a hundred thousand reversals of stress was very great.

A common type of repeated-stress testing machine is one in which a calibrated set of springs resist the tensile, compressive, flexural, or torsional stress set up in the specimen, and the deformation of the calibrated set of springs gives a measure of the force or moment acting on the specimen. Fig. 1 diagrammatically illustrates this type of machine which was used by Wohler, and has since been used by many other experimenters. The Upton-Lewis machine is of this type and extensive use was made of it in torsion tests carried out by McAdam. This type of machine permits a fairly high rate of alteration of stress, and machines which have been run at 1,000 repetitions per minute have given results apparently trustworthy.

The most common type of machine for reversed bending stresses uses a circular specimen acting as a rotating beam. This type was used by Wohler, and also by many later investigators. Fig. 2 illustrates such a machine. The specimen is in the form of a bar of circular section, to which bending stress is applied by weights. The specimen is rotated by means of a pulley. At any instant the outer fibers are subjected to a stress varying from tension on one side to compression on the other, and the fiber stress at any point passes through a cycle of reversed stress during each revolution. As shown, the specimen is loaded at two symmerical points of the span, and between these two points the extreme fiber stress is constant for each element along the bar. This type of machine permits high speed of reversal of stress, speeds up to 2,000 r.p.m. having been successfully used.

British experimenters have used repeated-stress testing machines, in which varying stress was applied to a specimen by means of the inertia of reciprocating parts. Fig. 3 shows such a machine which can be used at high speeds. However the speed must be very closely controlled, as the inertia forces very with the square of the speed. Moreover friction on the guides causes some slight uncertainty as to the magnitude of stress set up at each stroke of the crank.

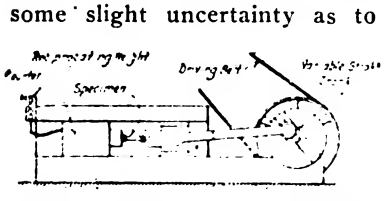

Fig. 3. British form of repeated stress machine

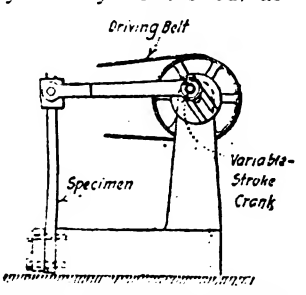

Fig. 5. Short time repeated stress testing machine

A repeated-stress testing machine depending on centrifugal force to produce cycles of stress is shown is Fig. 4. It is evident that as the eccentric weights revolve the specimen will be placed alternately in tension and in compression. The characteristics of this machine are much like those of the inertia type; in fact it is a special form of inertia machine. A type of machine used by Arnold and later by other experimenters, is shown in Fig. 5. In this machine a specimen is repeatedly subjected to deflction of a given amount. Usually this deflection is sufficiently large to stress the material well beyond the elastic limit, and no very definite stress value can be computed. This machine is used mainly for short-time tests. Another short-time-test machine uses the repeated impact of a small hammer. The claim is made that impact-loading emphasizes local flaws better than a load which is more gradually applied and that thus it indirectly gives a better index of fatigue strength. Data however are lacking to prove or disprove this claim.

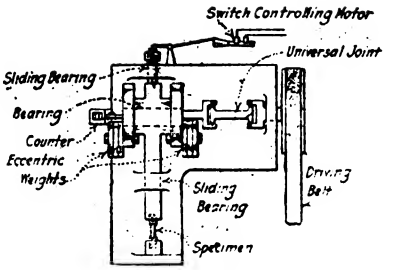

Fig. 4. Special form of repeated stress machine

Various repeated-stress-testing machines have been constructed in which the cycles of stress were set up by the action of an electro-magnet energized by alternating current. Usually the stress was measured either by the deflation of a spring or by the deformation of a standard test bar attached to the specimen. The speed of such a machine however is usually so high that there seems to be some uncertainty as to whether the successive waves of stress pass through the specimen without interference.

Automobile Body of Very Light Weight

Mention has been previously made in these columns of the influence of automobile engine design principles on the development of the aerial power plant and now we find that aerial designers are contributing to the refinement of automobile construction, especially as relates to body construction. Our contemporary, Automotive Industries, describes a special five-passenger sedan body which is claimed to weigh only 120 lbs. for a car of 112 in. wheelbase. These bodies are constructed on airplane fuselage principles and are of a three-ply veneer combination. The great strength and light weight of plywood permits it to act as a sheathing and at the same time contribute considerably to the strength of the structure. The veneers usually employed consist of two plies of birch with a ply of mahogany between. The thickness of the material used in the construction of the conventional auto body is one-eighth of an inch.

With gasoline rapidly approaching the 40c mark, it is understood that Alcogas, a substitute made from an alcohol base, will shortly be placed on the market as a competitor. From inside interests, it is understood that this can be sold at a substantial profit at 40c. It does not carbonize, contains no acid or corrosive, and is said to give more power.

The New and Unusual in the Automotive Field

Crankshaft Cheek Milling Machine for Large Motor Ship Engine Units—New Motor Car Wheel Made From Wood Indicates Many Advantages—Mead Valve for Tires Works Differently

It will be the policy of Automotive Manufacturer (as in Automotive Engineering) to present on these pages each month some car, truck, aeroplane, boat, tractor, engine or other unit which presents unusual and decidedly different engineering features

Crankshaft Cheek Milling Machine

Large and larger crankshafts needed for the greatly increasing sizes of Diesel and other motorship engines, have finally brought out several special tools for machining these units. Machining the outside surfaces of the cheeks of crank shafts upon a lathe is an expensive operation, due to the fact that there is a lot of lost motion and operating expense during the time the crankshaft revolves in the lathe and no cutting is done.

To eliminate this lost motion and operating expense, the Newton Machine Tool Works, Inc., Philadelphia, U. S. A., have recently developed the crankshaft cheek milling machine illustrated in Figs. 1 and 2.

The machine shown has a work table 72 in. long and 32 in. wide and on this work table there is fitted the crankshaft holding fixture, the top side of which is adjustable crosswise by means of a rack and hand operated pinion. This table has forward as well as reverse fast power traverse in addition to hand adjustment. The adjustment of the table will be controlled by a revolving screw and a stationary nut.

There are six changes of gear feed to the table, obtained through sleeves on which the gears are mounted in an oil tight box and these sleeves are controlled by latch levers outside the cover.

The main table has 30 in. of feed and hand adjustment along the base.

Each cutter head is 40 in. in diameter over the cutting tools and each cutter head saddle has independent hand adjustment on its wing to permit the heads operating within four inches of each other, or at a maximum distance between cutters of 30 in.

On the top side of the crankshaft holding fixture, a pair of centers for holding the crankshaft, is fitted. The center on the right hand side of the machine occupies a rigid position and the center on the left hand side has hand adjustment to permit of its insertion into the centers of the crankshaft.

Both centers are adjustable upon the top slide. the maximum distance between centers being 15 ft. The distance from the top of the main slide to the center of the center in which the crankshaft is to be placed, is 11 in

Suitable hand operated arch clamps are provided for clamping cranks while being cut.

Each cutter head is a solid steel casting with slots for the tools machined from the solid and the teeth of the driving gear cut from the solid in the rear of the head.

The width of each wing on which the spindle saddle will be mounted is 56 in. and the actual length of each spindle saddle bearing on the wing is 50 in. The height of each wing above the floor is 18 in.and the height of the main base on which the main table is supported is 38 in. Cutter heads are driven by individual motor, through internal gears, the latter fully enclosed.

Table is driven by motor of interlocking control type, so that in the operation of stopping the table, the motor will stop first and in the operation of starting the two driving motors for cutter heads will start first.

The New Dayton Discwood Wheel

A new and improved disc wheel for automobiles and trucks has just been announced by the Dayton Automotive Wheel Co., Dayton, O. This new wheel, according to the officials of the company, marks a distinct advance over any other wheel on the market.

Figs. 3 and 4 illustrate clearly the appearance of the wheel. Instead of being made of metal however as is the case with other wheels of this type, this new wheel is made of wood. Hence the name "Dayton Discwood."

The wheels are made from thin, rotary cut slices of wood glued together under great pressure. The grain of each piece running in a different direction from that of the piece next to it. This process of lamination makes the complete disc into a very strong, non-separable, non-

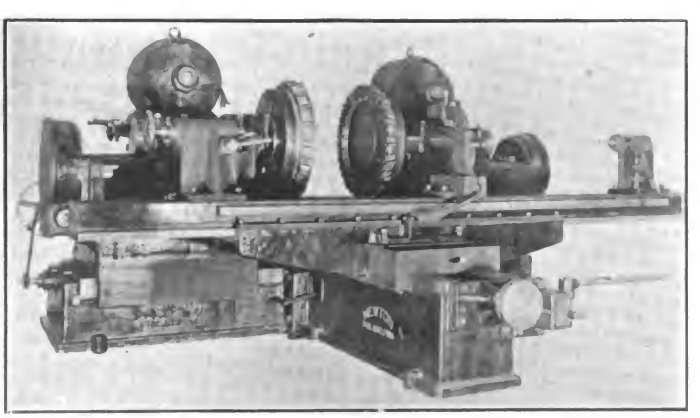

Fig. 1. End view of the Newton Crankshaft cheek milling machine

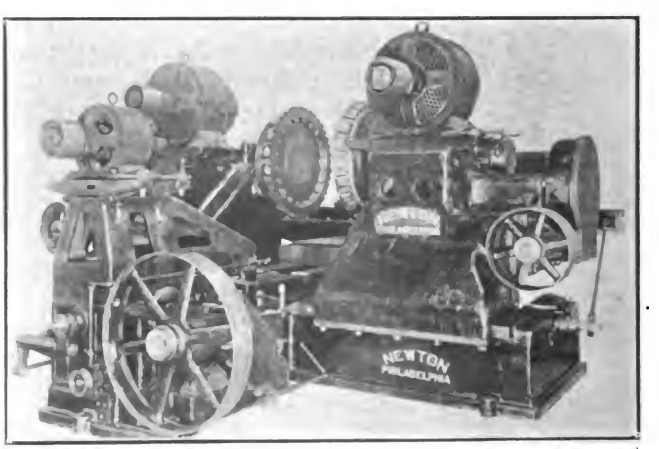

Fig. 2. Rear view of Newton machine showing electric motors and drive

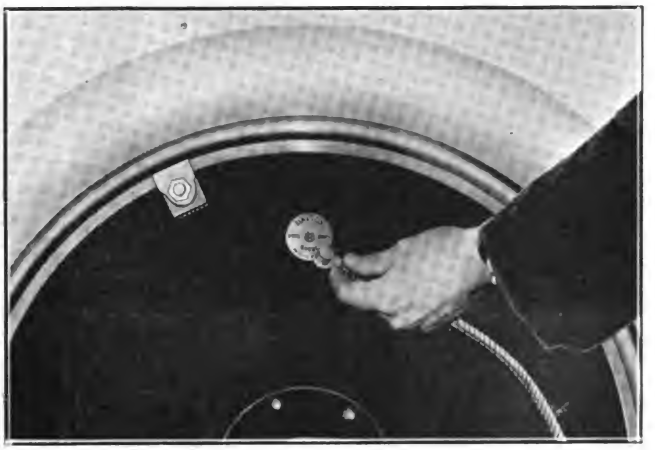

Fig. 3. Close up view of the Dayton Discwood wheel for motor cars

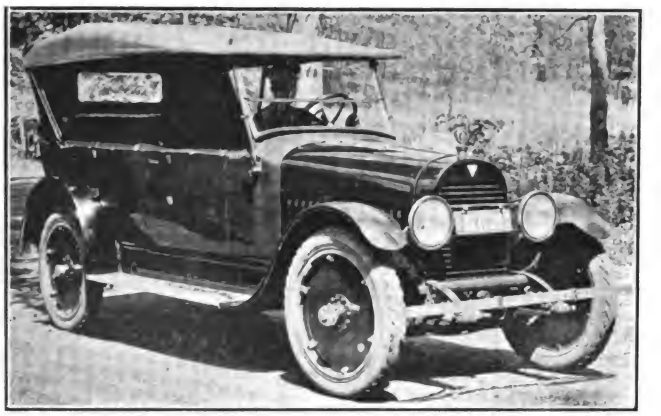

Fig. 4. Pleasing appearance of car equipped with Dayton Discwood wheels

warpable, but resilient whole, which at the same time is thoroughly waterproof.

The wheel has undergone thorough and severe tests both in the laboratory and on the road, extending over a long period of time. These tests show remarkable results both as to strength and durability. For example, it was proven, so officials of the company say, that the new "Dayton Discwood" wheel would withstand more than one hundred per cent more resistance to side strains than the spoke wheel. Road shocks, it is claimed, are distributed evenly throughout the wheel.

Besides unusual strength, the wheel has the additional quality of lightness. It is approximately the same weight as the ordinary spoked wheel. Tire and fuel economy is one of the results of this quality.

A point which will perhaps interests motorists and manufacturers more than any other is the ease and convenience with which the tire can be inflated. A practical patented angle valve attachment is applied to the wheel in such a way that the tire can be inflated from the outstide face of the wheel. The accompanying illustration clearly indicates this feature. This advantage can readily be appreciated by anyone who has had anything to do with inflating tires on the conventional types of disc wheels. In fact it is claimed that if the wheel had no other advantage, this one feature alone would entitle it to first consideration in the selection of an automobile wheel.

Any standard demountable rim can be used just the same as on the spoke wheel. Car owners can appreciate what this means.

Aside from the wood disc, the basic construction of the wheel is exactly the same as the ordinary spoked wheel—the same hub, rim and other steel equipment that is usually used being applied to the wheel.

These wheels enhance the appearance of the car, are easily kept clean, and will not gather nor carry mud.

The company back of the wheel has been manufacturing wheels in Dayton since 1859. It has established an enviable record for making high quality product in vehicle wheels for more than half a century. The new "Dayton Discwood" wheel for automobiles is a logical development in the wheel business.

Mead Tire Valve Works Differently

How many automobile owners who seek to get the utmost from their tires do not lay the blame on the tire if it gives out prematurely? There are not very many. If the motorist were to search deeper for the real reason he would discover that in a great many cases the tire valve has something to do with the wearing out of the tire. If a tire is not inflated to the correct pressure at all times it cannot be expected to give the service that it is guaranteed to give, and if the valve is not capable of holding the air, the pressure cannot be maintained. A Canadian inventor, Lieut. Mead, has evidently discovered the true secret of the air tight valve, and hence the secret of getting all from the tire that it is supposed to give.

The Mead valve, shown in Fig. 5, has been tested in every manner of test that a tire valve can be put to, by large tire companies, and they have found it in every way suitable. Automobiles equipped with them for six months are still running on the air that was put in the tires at the beginning of the test, showing the great air retaining qualities of the valve.

The construction of the Mead valve is very simple but insures thorough efficiency. It is constructed so that in place of the old style small, light and delicate plunger operating in a solid shank, it has a heavy brass coil wire spring attached to a one-eighth inch brass tubing, through which the air passes when released by pressure on the plunger top. The air passes through two air port vents in the plunger, which is kept absolutely sealed under all conditions by the heavy spring.

The plunger is held in position by a beveled shell, which is a separate part and screws into the top of the shank. As all the Mead parts are standard in size, if this plunger should be injured in any may, which is very improbable, on account of the sturdy construction, a new part can be put in, and thus all the trouble and cost of installing a new valve, as would have to be done in the case of the old style valve, is eliminated.

The simple and certain principle on which the Mead valve op-

Fig. 5. Part elevation, part section of Mead air valve

erates, namely, that of a strong coiled spring, precludes any possibility of leakage of air through the valve. No vestige of air can possibly escape until the plunger is pushed down far enough to bring the air port holes out of the shell in which the plunger works, the inside being conically bored. The moment that the pressure is released the spring immediately pushes the plunger back into this conical boring, and it remains hermetically sealed until deflation is again required.

The construction makes inflation quick and easy, because of the two large air passages which admit a large body of air. It transmits the entire contents of the pump

American Entries in Gordon Bennett Airplane Races

America's three entries in the Gordon Bennett international airplane trophy races are on their way to France, where the race will be held at Etamps, near Paris, Sept. 27-Oct. 3, 1920, over a circuit course of 300 kilometers (186.3 miles). The winner will draw a prize of 10,000 francs from the Aero Club of France, the Bennett cup valued at $2,500 and many other prizes.

The Gordon Bennett aviation trophy is put up under the rules of the Federation Aeronautique Internationale. The rules are changed each year as the art of flight progresses, thus making it more difficult to enter without machines of the latest type, design and speed.

Glenn H. Curtiss won the first race in 1909, using his biplane which though attaining a speed of only 47 miles an hour was more than fast enough to beat the seven other entries from European countries. Claude Graham White in a Bleriot monoplane won for England in 1910. He flew at 63 miles an hour. C. T. Weyman, an American, brought the cup back to this country in 1911, using a Nieuport monoplane with a speed of 80 miles an hour. Jules Vedrines came over from France and returned with the trophy in 1912. He used a Deperdussin monoplane and made 105 miles an hour. Maurice Provost, another Frenchman, used a machine of similar make in 1913 and won out at a speed of 126.59 miles an hour.

Great Britain, France and Italy are listed among the twelve entries as America's chief competitors; but Germany, barred from participating in the race, is believed to have entered four or five of her latest machines through the neutral countries, such as Holland, Denmark and Sweden. Airmen are of the opinion that the winner of the race will have to make more than 200 miles an hour.

All entries must carry sufficient fuel for the entire flight of 186 miles. Pilots may use their own fuel. This is interesting because it means that all the new kinds of fuel on which individual companies throughout the world have been experimenting since the outbreak of the World War will be used. Synthetic fuels will be used in at least one American entry, that of the Dayton-Wright. Superchargers are not forbidden; the assumption therefore is that superchargers will be used.

Two of the three American planes are monoplanes, the Curtiss and the Dayton-Wright. The army air service contestant is a biplane.

In the Curtiss "Arrow" the pilot's seat is far in the rear part of the body, about two-thirds of the distance from the nose to the tail. The plane has a short and stubby propeller, with streamlined hub. It has a monococque body. The wing is very thick, supported on each side by a single thick strut extending to the hub of the landing wheel. It has a bird cage radiator, one on each side, as if slung on the running board of an automobile. It is powered with a Curtiss C-12, V type, 12 cylinder, 400 h.p motor.

The Dayton-Wright "R-B" has a wing of three-ply wood veneer, instead of the usual fabric covering. The entire landing gear, including the wheels, is drawn up inside of the machine while in flight. The pilot simply turns a crank on the instrument board in front of him, and in twelve or fifteen seconds only the wheels fitting snuggly into portholes just back of the nose evidence the existence of a landing gear. The same movement of the pilot in turning the crank also flattens out the wing, removing the curve which lowers the speed of the plane from 20 to 35 miles an hour in landing, and in flight with the wing flattened out increasing the speed proportionately. The machine has a monococque body. It is powered with a special 250 h.p. Hall-Scott motor.

The airplane entered by the United States army air service is known as the Verville-Packard and is of all American design and manufacture. The motor of 500 h.p. was designed and built by the Packard Co. The new motor has a piston displacement of over 2,000 cu. in., and weighs approximately 1.94 lbs. per h.p.

The Verville plane was designed and constructed especially for this motor; it is not a freak racing plane, but built for both service and production. The plane itself has been developed by the engineers of the office of the chief of the air service at the engineering division at McCook Field. It has one strut supporting its wings on either side. All planes are of the tractor type. All three planes are small, and seat only one person each.

The Curtiss entry will be piloted by Roland Rohlfs, chief test pilot for the company and former holder of the world's altitude record. Capt. Rudolph Schroeder, present holder of the world's altitude record, will pilot the army plane. The Dayton-Wright entry will be piloted by Howard Rinehart, chief test pilot for the Dayton-Wright Division of the General Motors Corp.

Shortage of Gasoline in Canada

Advertisements asking everyone to conserve gasoline are being run throughout Canada by oil companies. There is said to be a shortage of gasoline and it is reported that in the last few years the demand for crude peroleum, practically all of which comes from the United States, for the manufacture of gasoline in Canada, has increased more than 650 per cent. In the same period production has increased about 150 per cent. A shortage of crude oil and high prices necessarily follow. Pennsylvania crude is today costing $6.10 and Oklahoma crude $3.60 per barrel at the wells, and these prices must be paid in American funds, which adds another 15 per cent.

The oil producing companies claim to be sparing no expense or effort to meet the growing demand for petroleum products, but notwithstanding the best efforts of these companies the demand is growing ahead of production by leaps and bounds. The only apparent solution is to use all petroleum products, especially gasoline, economically and efficiently. Those who have studied the subject say that one-half gallon of gasoline per car is wasted daily in Canada through carelessness, the overuse of cars, and needless mileage, which means 200,000 gallons wasted daily in the country, or 73,000,000 gallons per year if all motor cars were operated every day.

New and Improved Ideas in Body Finishing

Paints and Varnishes in South Africa

While South Africa is at present depending upon other countries, and in particular the United States, for its paint and varnish supply, the manufacture of these promises eventually to be an industry of considerable importance there. The raw materials are being found in increasing quantities, in fact, almost inexhaustible supplies of earth pigments, ochres and oxides are said to exist in South Africa, from which practically every color may be obtained. Imports of ochres and of linseed oil are diminishing.

But although the local manufacture of paints is forging ahead, the output is still far from sufficient to meet the demand, and the United States has a comparatively large field for exports of this class in South Africa. In 1917 the total value of imports of paints and varnishes amounted to $951,615. The United Kingdom furnished goods of this character to the value of $951,615, and the share of the United States amounted to $206,301. In the trade in turpentine and substitutes, the United Sates ranked first with a value of $83,280 out of a total of $88,225. The United States also excelled as a source of supply for water colors and distempers, supplying such materials to the value of $31,481 out of a total trade valued at $57,064. But the United Kingdom had almost a monopoly of the varnish trade, which amounted to $128,787, and in which the United States shared only to the extent of $15,816. Paints and varnishes of "all other kinds" were valued at $632,631, divided as follows. Great Britain, $495,770; United States $95,724; Canada, $25,413; other countries $15,724.

Ready made paints for the jobbing trade are usually sold in lever tins, packed 48 tins to the case. The better class of goods for specialists are commonly shipped in closed cans of 2 and 5 gals. of imperial measure. Buying by weight is generally per 100 lbs., but some merchants prefer quotations on 112 lbs. As a rule quoting a net price is declared to bring quicker results than giving various discounts, particularly inasmuch as the most common means of settlement in trade of this kind is by cash against documents. However goods are frequently placed through agents and different prices quoted, with terms of credit ranging from 30 to 60 to 90 days.

White zinc is not used in large quantities and that which is imported is principally of British manufacture. On the other hand, white lead is extensively employed, and the United Kingdom is the chief source of imports While the British brand, "Genuine," is said to have a large sale and to be popular, there is a market for a line of not quite so good a quality.

Colors in oils and japan are not used to a large extent. Dry colors are handled in large quantities in the form of water paints known by the name of distempers. Almost every brand is on sale in South Africa. Carriage manufacturers use dry colors in fairly good amounts. Enamels are also sold in the large trade centers, and are mostly of white and of fine quality.

A Paint to Withstand Gasoline

A good enamel paint, provided it is properly dried, and especialy if it has been baked, will withstand gasoline. Enamel paints are made in the same way as ordinary paint, only that in place of linseed oil enamel vanrish (pale copal) is employed for grinding. The pigments are first ground to a stiff paste with the varnish in a cone paint mill, and then thinned out with turpentine. Ordinary glue withstands gasoline perfectly, and paints can be made by grinding the pigments with water as above and mixing them with glue size; but these paints are more transparent and therefore cover less than the oil paints. A washable distemper will also withstand gasoline. This can be made by mixing together 20 parts of casein, 3 parts of strong soda solution, and 177 parts of whiting, or of a mixture of whiting and pigment, thinning out with water as required.—Exchange.

Physical Tests for Paints and Varnishes

All the big paint and varnish concerns realize the importance and value, in fact absolute necessity of physical tests as a reliable means of ascertaining the value of paints and varnishes for the purposes for which they are intended, and these far-seeing manufacturers maintain a competent corps of skilled workmen, whose duty it is to test physically every batch of finished products before it is allowed to leave the factory. Not only this, these same workmen test many of the raw materials before they are allowed to go into the manufacturing department.

Of course all these establishments have chemical laboratories, and their chemists ascertain the degree of purity of the various raw materials, but in addition to the chemist's report it has been found most advantageous to also have physical tests made. Physical tests are not intended to supplant chemical investigation, but the workman who conducts the physical tests is intended to act with the chemist in an effort to ascertain everything possible in the way of knowledge regarding any piece of manufactured goods. In this way while complaints are not altogether eliminated, they are reduced to the minimum. Experience has demonstrated to the larger manufacturers the wisdom and good business policy of having experienced workmen subject all their finished products and many of their raw materials to the most rigid physical tests, in order that the goods sent out may be as nearly "fool proof" as possible. They find that this pays and pays well, not perhaps in permitting the manufacturer to get more per gallon for product than he would otherwise, but in eliminating complaints and fortifying the manufacturer for a show down when a complaint is made.

Progress of the New Zealand Kauri Gum Industry

The kauri gum industry of New Zealand dates back to 1868, from which time to 1886 the yield of the gum bearing lands in the northern province amounted to from 2,000 to 4,000 tons annually, obtained by the most primitive methods. This increased in the following 20 years to an overage of 8,000 or 10,000 tons, which gradually declined until in 1916 and 1917 between 4,000 and 5,000 tons only were obtained. The gum bearing swamps are the site of ancient kauri forests in which the deposits of gum are added to by the constant shedding from the kauri tree of its bark scales and leaf stems, on which little beads of gum have formed. Heretofore that obtained by digging, grubbing, hooking and tree climbing was all such as could be readily seen and handled, ranging from pieces the size of a nut to those weighing over

100 lbs. Now it is realized that in certain classes of soil gum also exists in a very fine state of division, and it is proposed to work this soil on a large scale by mechanical appliances.

Strong Adhesive Made From Snails

Many of the larger kinds of snails have at the extremity of their bodies small white bladders filled with a gelatinous substance. It has been discovered that this is the strongest adhesive known for the repairing of porcelain glass, etc. The substance is applied thinly to both sides of the fracture and the broken piece is tied firmly together so that all is held in place. A rather longer time for drying should be given than in the case of ordinary adhesives so as to allow the natural glue to acquire the greatest degree of strength. When it is once really set the tenacity of this remarkable adhesive is astonishing.

Attractive Painting for Business Vehicles

The business vehicle, whether motor truck or wagon, deserves to be attractively painted, for the finely painted and varnished vehicle carries advertising possibilities of no mean order. Contributing to this in no small degree are the color selections. The ribbed body calls for specially pleasing colors. Here are some of the colors which look well on the ribbed type of body. Chrome or milori green for panels; black for ribs and frame. Indian red glazed with No. 40 carmine; ribs and frame black, striped with English vermilion. Medium chrome yellow; ribs and frame of same color, and striped with fine lines of vermilion. Another style: deep English vermilion; ribs black and striped with fine lines of light English vermilion. Still another style: medium shade of carmine; ribs and frame black and striped in fine lines of gold. Olive or Brewster green look fine and good on the type of wagon body here referred to. In painting the running parts, make these parts without any exception, of a little lighter color than that given the body. Stripe in colors appropriate to the colors employed, size of job, etc.

In painting wagons the advertising advantages should not be lost sight of. Every business wagon has certain advertising possibilities and these should not be destroyed or rendered void by a color selection which perhaps has only certain elements of durability.

Durability is a great issue—perhaps the main issue—but the advertising advantages of the work—the power to attract favorable attention—is a point entitled to supreme consideration. Color selection then cannot be too carefully made. The vehicle beautiful and the vehicle durable depend upon it.

Proper Preservation of Brushes

It always pays a large rate of interest on the investment to give brushes the best possible care and treatment. They are the tools with which the painter builds up or tears down his business. Profit and loss are decided by their use. More paint brushes are worn out or destroyed through abuse than by a right use. Paint brushes that have become hard at the working end of the bristles may usually be restored to a state of usefulness by suspending them in a glass jar containing a solution of one part crystalized sodium carbonate in three parts of water. Suspend the brushes in this medium so that they will swing free from the bottom of the jar, and confine the latter in a container warmed to a temperature, for fifteen hours, of 135 deg. F. Then wash out in soap suds and rinse in cold water. This same class of brushes may also be restored to their original condition by immersing them in liquid varnish remover, then washing in denatured alcohol. Brushes which through neglect or accident have become "saggy" can be restored more often than not to a normal condition by soaking them for a few minutes in hot turpentine. The same thing may be accomplished by an immersion in hot linseed oil. The varnish brush accidentally dropped upon the floor, if held at an angle of 65 deg., with a good volume of turpentine flowed over it, and then drawn over the edge of a putty knife, may be made workable at once. Turpentine however is not a good material in which to wash a chronically dirty brush It serves to loosen and set in motion the dirt atoms. The "lousy" brush, so termed by varnishers. is an unsavory tool. Instead of going to the expense of putting a brush so afflicted through a series of cleaning operations, throw it away. The varnish brush moderately dirty may usually be cleaned by first washing thoroughly in raw linseed oil, next in turpentine, and then working it in rubbing varnish. In due time such a brush may be worked out and developed into practically a clean brush. Varnish brushes when not in use should be kept in a container, air tight, and holding enough finishing varnish without driers to cover the workig stock of the tool.

Gasoline Increases, Crude Oil Decreases

During the month of April the production of gasoline increased much faster than its consumption, so that there was an excess to add to the reserve stocks. The production of crude oil however for that month again ran behind consumption so that stocks were decreased. This means, if it means anything, that oil refiners are getting a much geater quantity of gasoline out of the crude than ever before, so much greater in fact that a relatively large shortage of the crude is converted into a very considerable excess of motor fuel.

For April the Bureau of Mines and Amer. Petroleum Institute report that the production of gasoline was 11,421,843 gal. while the consumption was but 8,591,912 gal. The excess almost three million gallons, increased the reserve stocks to 643,552,644 gal.

In the same month the production of crude oil amounted to 36,349,000 bbls. and the consumption to 37,073,000 bbls. The shortage of 724,000 bbls. decreased the stocks on hand to 124,873,000 bbls.

Both production and consumption were slightly less than in March due to the shorter month, the daily average in each case being higher. If proper allowance be made for this, April was the fourth successive month in which the consumption has exceeded the production, the difference being made up either from stocks which have decreased almost 5,000,000 bbls. this year, or from an increase in imports of Mexican crude oil.

S. T. D. Motors, Ltd., is a new British incorporation which is said to represent the consolidation of Sunbeam Motor Car Co. with Talbot-Darracq, the latter itself a consolidation of the former Talbot and Darracq interests. The new company will be a very large one and may have a capital in excess of £4,000,000.

Current Automotive Metal and Supply Prices

General Business Conditions the country over have improved materially in the last 30 days. Transportation is slightly better, labor is showing a better attitude toward work and greater working efficiency, pig iron output for July was very high, almost a record month, crops are all on the bumper order except wheat, of which there is a large carryover, and money seems to be easier. Indications are that by this time next month manufacturers of all kinds will be upon a much sounder basis than at any times since the early summer of 1914.

Iron and Steel July production of pig iron was 24,000 tons greater than that of June, although the daily average was slightly less. Moreover the larger part of this and considerable iron from storage (amounting in some cases to 20 per cent) was sold and transported despite prices approximating $50 a ton. Steel production was slightly greater than the previous month also.

Copper and Aluminum Copper and aluminum both continue very quiet with prices firm. In the face of light domestic and little foreign business, producing interests are maintaining prices. Freight advances are expected to increase prices, so sellers are not anxious.

Lead and Tin Lead maintains the same price level, 9c New York, although the brisk demand of mid-July has disappeared. It is said that Britain is shipping lead to this country. If true this will lower prices. Consumers are not interested in tin, so the market is unusually dull. Monthly statistics show that 1,660 more tons were delivered into consumption than arrived, which predicates a higher price level shortly.

Zinc and Other Metals Producers of zinc are taking care of the demand for spot delivery only, being contented otherwise to wait the turn of the market expected in September. It is expected that the freight advance will have an influence on this also. Antimony is available at 7.25c New York, duty paid. Ferrosilicon is easier. Mercury is up to $90 a flask. Sheets, hoops and bands are lower and easy to get on account of considerable automobile cancellations. The premium on sheets is off for the first time in 5 years for this reason.

Old Metals Most of the old metals are quiet and unchanged with the exception of lead. Steel and iron scrap are unchanged also, with the exception of carwheels, Chicago, up $2 a ton from the last quotation.

Chemicals The market is quiet and unchanged except for the acids and coal tar products, which seem to have reached a firm price basis at last. Naval stores are firm, although turpentine is down slightly from last month.

Other Materials The oils show no change, Pennsylvania is still quoted at $6.10 a barrel with a premium for spot delivery. Much gasoline is being added to storage, which now totals more than 650,000,000 gallons. All rubbers are weaker, in fact the rubber situation is very serious, other large firms besides those mentioned last month being in critical shape. Hides are more active and firmer, with Bogotas quoted at 30 and dry hides firm. Bogota goat skins are quoted at $1 @ $1.10.

Every effort is made to have the following prevailing prices (compared with last month's) accurate but none is guaranteed. They are obtained through trade sources and may not be realized on small quantities:

	July 14	Aug. 2
Acid, Sulphuric, 66°.....ton	26.00 —28.00	18.00 —20.00
Alcohol, Ethyl, 97 p.c.....gal.	6.00 — 7.00*	5.00 — 7.00
Alcohol, denatured, 190 proof, gal.	1.05 — 1.10*	1.05 — 1.10
Aluminum, Ingots No. 1 99% pure, carload lots.....lb.	.35 — .38	.35 — .38
Ammonium Chloride (Sal-Ammoniac) white, granular....lb.	.17 — .18*	.17 — .18
Babbitt Metal, best grade.....lb.	.90	.90
Babbitt Metal, Commercial....lb.	.50	.50
Beeswax, natural crude, yellow.lb.	..	——
Carnauba No. 1 Wax.....lb.	1.00 — 1.05*	1.00 — 1.05
Caustic Potash (85-92 p. c.)..lb.	.35 — .38	.35 — .38
Caustic Soda, 76 p. c.....100 lb.	6.50 — 7.50	6.27 — 7.00
Pumice, Ground (domestic)....lb.	.04 — .07	.04 — .07
Shellac, Orange, superfine....lb.	1.50	1.45
Tin, Metallic straits pig.....lb.	.51	.53
Turpentine, spirits of crude.....	1.75	1.69
Zinc, Western Spelter.....lb.	.10 — .11	.10 — .11
No. 9 base casks, open.....lb.	.15	.15

*Nominal

IRON AND STEEL, PIG, BARS, ALLOYS, OLD METAL

Pig, per ton—	July 13	Aug. 3
No. 2 X, Philadelphia§.....	$48.15	$49.15
No. 2, Valley furnace†.....	45.00	46.00
Basic, delivered, eastern Pa.....	43.00	44.40
Basic, Valley furnace.....	46.00	46.50
Bessemer, Pittsburgh	47.40	48.40
Malleable, Valley	45.00	46.50
Refined iron bars, base price....	5.25c	5.25c
Soft Steel—		
¾ to 1⅞ in., round and square..	3.52—5.25c	3.52—5.25c
1 to 6 in. x ⅝ to 1 in.....	3.52—5.25c	3.25—5.25c
1 to 6 in. x ¼ and 5/16.....	3.62—5.25c	3.62—5.25c
Rods—⅝ and 11/16.....	3.57—5.05c	3.57—5.05c
Bands—1½ to 6 x 3/16 to No. 8..	4.22—6.50c	4.22—6.50c
Ferromanganese, 76% to 80% delivered producers' price.....	$200.00—225.00	$200.00
Spiegel, 18% to 22% furnace, spot	70.00— 75.00	75.00—85.00
Ferrosilicon, 50%, spot, delivered	80.00— 85.00	70.00—80.00
Old Metal		
Heavy steel scrap, Pittsburgh...	40.00	27.00
Heavy steel scrap, Philadelphia..	37.00	23.00
No. 1 cast, Pittsburgh.....	40.00	41.00
No. 1 cast, Philadelphia.....	37.00	38.00

†Silicon, 1.75 to 2.25. §Silicon, 2.25 to 2.75.
Ferrosilicon prices at Ashland, Ky., Jackson and N. Straitsville, O.

BOLTS AND NUTS

(Discounts are from Nov. 1, 1919)	July 13	Aug. 3
Machine bolts, c.p.c. and t. nuts, ⅜ x 4in.; Smaller and shorter..	30	30
Carriage bolts, ⅜ x 6 in.:		
Smaller and shorter, rolled threads	30—10	30—10
Cut threads	30	30
Semi-finished hex. nuts:		
⅜ in. and larger.....	50—10	50—10
9/16 in. and smaller.....	50—10	50—10
Tire bolts	50	50

BRASS, COPPER SHEETS, SHAPES, VIRGIN METAL, SCRAP

	July 13	Aug. 3
Copper, Lake, ingot.....lb.	$0.19	$0.19
Copper, Electrolytic .....lb.	.19	.19
Copper, Casting .....lb.	.18½	.18½
Copper sheets, hot rolled.....lb.	.33½	.33½
Copper sheets, cold rolled.....lb.	——	—
High brass wire and sheets....lb.	.30¼	.30¼
High brass rods.....lb.	.25	.25
Low brass wire and sheets....lb.	.28½	.27½
Low brass rods.....lb.	.29	.29
Seamless bronze tubing.....lb.	——	—
Seamless brass tubing.....lb.	.33	.33
Old Metal—		
Copper light and bottoms.....	.15	.13¾—.14¼
Brass, heavy	.13	.09½—.10
Brass, light	.09	.07¼—.07¾
Heavy machine composition.....	.17¾	—
No. 1 yellow brass turnings.....	.10½	.09 —.09½
No. 1 red brass or comp. turnings	.15	.12½—.13

CRUDE RUBBER

	July 14	Aug. 2
Para, Upriver fine.....lb.	$0.34¼—.35	$0.32 —.33
Upriver coarse .....lb.	.24 —24½	.23 —.24
Upriver caucho ball.....lb.	.26 —.26½	.23 —.24
Plantation, first latex crepe...lb.	.32½—.33	.32½
Ribbed smoked sheets.....lb.	.33 —.33½	.31½
Brown crepe, thin, clean....lb.	.32 —.32½	.30

PETROLEUM PRODUCTS

	July 20	Aug. 10
Oil—Pennsylvania Crude	$6.10	$6.10
Kansas and Oklahoma Crude..	3.50	3.50
Gasoline, Motor, garages, steel bbls..	.30	.30
Consumers, steel bbls.....	.32	.32
Lubricating Oil, black, 29 gravity	.28—.33	.28—.33
Cyl. light filtered.....	.90—.95	.90—.95
Dark filtered	.83—.85	.83—.85

Men of the Automotive Industry

Who They Are What They Are What They Are Doing

E. R. Bacon, who recently sold his interests in the Horizontal Hydraulic Hoist Co., Milwaukee, to Gar Wood and associates, of the Wood Hydraulic Hoist Co., Detroit, has gone to San Francisco to take personal charge of the Edward R. Bacon Co., distributor of the hoists on the Pacific Coast and in the Orient. The Milwaukee plant makes horizontal hoists exclusively, while the Detroit plant builds vertical types. Logan Wood, vice president of the Wood Company has moved his residence from Chicago to Milwaukee to be general superintendent of the local works.

John N. Willys, president of the Willys-Overland Co. and of the Willys Corp., this week enlarged his holdings in the Republic Truck Co., Alma, Mich., and assumed the post of president of that company, too. This was accomplished through his acquisition of the stock held by Frank W. Ruggles, identified with the company's ownership for a long term if years, and prominent in its dovelopment to one of the largest motor truck manufacturers in the industry. Ruggles retires from all connection with the company, a large number of other interests claiming his attention.

Charles P. Grimes has joined the Franklin Automobile Co., Syracuse, N. Y., in the capacity of research engineer. Grimes was in charge of most of the dynamometer laboratory tests for the Government during the war, and is credited with being the man who first created successful motion pictures of air currents. Just previous to joining the Franklin organization, Grimes was with the Root & Vandervoort Engineering Co., and has also been connected at various periods with the Wheeler & Schebler Carburetor Co. and the National Motor Car & Vehicle Corp.

B. G. Koether, who was advanced to vice president of the Hyatt Roller Bearing Co., the early part of the year, has been made assistant general manager of the Hyatt Division of the General Motors Corp. Although he still remains a vice president of the Hyatt selling company, Mr. Koether has relinquished his duties as director of sales and advertising work to devote his entire efforts to boosting Hyatt production. This work will keep him at the company's plant at Harrison, N. J., where he has made his headquarters since leaving Detroit.

F. R. Speed, former engineer and production manager in the East for the Crane Engineering Co., has been elected vice president of the Federal Corp., Westfield, Mass., and will be in charge of manufacturing and production. Fred E. Wells, identified with financial and merchandising interests, has succeeded C. W. Dodson as treasurer. The company, which has been making Liberty spark plugs exclusively, has organized a department for the manufacture of Croxford rim tools and another for the marketing of an electric socket plug.

P. W. Hine has been made general distribution manager Hare's Motors, New York, with offices in New York City. Mr. Hine succeeds E. A. Travis, who has taken over the New York Locomobile branch, the largest and most important Locomobile sales branch in the country. Mr. Hine was until recently Locomobile division distribution manager. Prior to that he was assistant general sales manager of the Locomobile Co. He was connected with the Locomobile Co. previous to Hare's Motors control for 8 years.

Col. H. W. Alden, past president of the Socley of Automotive Engineers, Inc., has been designated as representative of the society on the Federal Highway Council Transportation Committee, and also on the Committee of Sub-Grade in its relation to road surfacing. Col. Alden is vice president of the Timken-Detroit Axle Co., Detroit, Mich., and is taking an active part in the development of highways and highway transportation.

W. J. Dunston has rejoined his old chief, Christian Girl, in accepting the position of chief engineer and factory manager of the Kalamazoo Spring & Axle Co., Kalamazoo, Mich. Dunstan formerly served as chief engineer of the Perfection Spring Co., chief engineer of the spring division of the Standard Parts Co., and engineer with the axle division, Standard Parts Co., respectively.

Louis P. Mooers has resigned as chief engineer of the Ahrens-Fox Co., Cincinnati, a post he has held for several years. Mooers was at one time a prominent trade figure when as chief engineer of the Peerless Motor Car Co. he brought out the first four cylinder vertical motored American car built on foreign lines and adopted much of the European methods of construction.

J. H. Williams & Co., 400 Vulcan Street, Buffalo, manufacturer of drop forgings and drop forge tools, has arranged for a bond issue of $1,500,000 for proposed expansion. It has completed negotiations for the purchase of the drop forge department of the Whitman & Barnes Mfg. Co., Chicago, with branch plant at St. Catharines, Ont. J. Harvey Williams is president.

George M. Graham has been elected vice president of the Pierce-Arrow Motor Car Co., succeeding W. J. Foss, who resigned July 1. Mr. Graham went to the Pierce-Arrow Motor Car Co. from the Willys-Overland Co., and during his four years at Buffalo has successively held the place of assistant commercial manager, general sales manager and now vice president.

W. H. Cowdry, president of the American Fork & Hoe Co., and G. B. Durell, treasurer of the same concern, have become heavy stockholders in the L. M. Axle Co., of which Durell now becomes president, treasurer and general manager and Cowdry chairman of the board of directors. Leo Melanowski, automotive engineer, is the inventor of the axle.

Clarence D. Patterson, who for the last three years has been connected with the Paige Motor Car Co., Detroit, as closed body engineer, has resigned to accept a position with the Locomobile Co., Bridgeport, Conn., in their body division. Mr. Patterson is well known in the trade as a capable designer and draftsman.

Glenn L. Orr was elected secretary, treasurer and general manager of the Lansing Foundry Co., Lansing, Mich., and assumed his new duties June 1. He has been connected with the Detroit Engine Works, Hupp Motor Corp., Packard Motor Car Co. and the Briscoe Motor Co., Jackson, Mich.

Kenneth A. Moore, formerly general agent of the New York Central Lines, has been added to the staff of the National Automobile Chamber of Commerce as assistant traffic manager in the western district with headquarters at 1009 Ford Building, Detroit.

Charles I. Ochs has been promoted to the position of general manager of the Eaton Axle Co., Cleveland, O. Ochs has been assistant general manager since the Eaton Axle organization was placed in charge of the Axle division of the Standard Parts Co.

Major T. T. Williams has been made executive manager of the Economy Baler Co., Ann Arbor, Mich. He was formerly with the Packard Motor Car Co. as an efficiency engineer, and during the war was in charge of the aerial photographich unit.

Charles F. Herb has joined the Sinclair Motors Corp., New York City, becoming vice president in charge of finances. Herb comes to the Sinclair company from the Hibernia Bank & Trust Co., of New Orleans, where he was vice president.

B. G. Prytz has been elected managing director of the S. K. F. Company, Gothenburg, Sweden. F. B. Kirkbride, vice president since the organization of S. K. F. Industries, was elected president to succeed Mr. Prytz.

Harry B. Bannister has succeeded to the presidency of the Muncie Wheel Co., Muncie, Ind., formerly held by the late O. B. Bannister. John Kinneer has been appointed vice president and C. N. Waterhouse sales manager.

George A. Shoemaker has been appointed works manager of the Bound Brook Oil-less Bearing Co., Bound Brook, N. J. He formerly occupied a similar position with the David Lupton Sons Co. of Philadelphia.

Capt. L. E. Gossett, a graduate from the Motor Transport Corps of the U. S. Army will assist the Motor Truck dept. of the National Automobile Chamber of Commerce in the Rural Motor Express Division.

Fred H. White is now assistant to the president of the Toledo Steel Products Co. of Toledo. For five years he was connected with the purchasing and service departments of the Willys-Overland Co.

H. H. Edge has been succeeded as works manager of the Locomobile Co., Bridgeport, Conn., by E. L. Larson, formerly with the Detroit Pressed Steel Co., Detroit.

W. H. Radford, chief engineer in charge of all engineering and inspection for the Saxon Motor Corp., has resigned. He has announced no plans for the future.

Fred A. Bigelow has been elected president of Carpenter Steel Co., Reading, Pa., succeeding W. B. Kunhardt, who becomes chairman of the board of directors.

H. J. Douglas has resigned as controller of Standard Parts Co., Cleveland, and has been made treasurer of the Ewing Bolt & Screw Co., Detroit.

Claude Hall has left the J. C. Wilson Co., to become general superintendent of Reynolds Motor Truck Co., at Mount Clemons, Mich.

Chauncey H. Murphy has been elected a director of the Locomobile Co., Mercer Motors Co., and Hare's Motors.

Carl H. Page has been appointed director of sales and advertising, Saxon Motor Car Corp., Detroit, Mich.

G. F. Lewis and H. B. Tibbitts have been added to the board of directors of the Stromberg Carburetor Co.

OBITUARY

Charles Ethan Billings, founder of the Billings & Spencer Manufacturing Co., died June 5 at his home in Hartford, Conn. He was 84 years old. Widely known as an invertor in the hardware and tool line, Billings was at one time president of the American Society of Mechanical Engineers and a member of its honorary council. He was active in civic affairs in Hartford, too, serving numerous terms in the city council, and having a large part in building its fire department. He was also active in banking affairs, having been president of the State Savings Bank of Hartford, and a director of the Hartford Trust Co.

Additional Notes of Parts Manufacturers

Phineas Jones & Co., 305 Market Street, Newark, N. J., manufacturer of automobile and truck wheels, demountable rims, etc., has broken ground for the first unit of its proposed new plant at Liberty and Hillside Avenues, Hillside. It will be a one story, brick, and will give employment to about 200 persons. The company has 7 acres of land at this location.

Hydraulic Steel Co., Cleveland., recently offered 75,000 shares of stock to its employees. All this was taken up at once and more, the exact total subscription being 84,988 shares. As a result of these purchases, approximately 45 per cent of the employees are now stockholders and own nearly 35 per cent of the common stock.

Leeds & Northrup Co., 4901 Stenton Avenue, Philadelphia, manufacturer of electric measuring instruments, has acquired three acres on Germantown Avenue, near Wayne Junction, for a consideration of about $35,000. It is planned to use the site for the erection of new works.

P. R. Piston Ring Co., Eau Clair, Wis., is a new corporation organized by C. M. Pratt, Edward L. Ross and Joseph C. Culver, all of Eau Clair, to engage in the manufacture of piston rings and other parts and devices for the gas engine and automotive industries.

Activities of Automotive Manufacturers

Where They Are Located What They Are Doing How They Are Prospering

Ford Motor Co. and Henry B. Ford & Son are about to be merged in a new Michigan corporation with $100,000,000 capital, organized under Delaware laws. The present capital of the Ford Motor Co. is $2,000,000 paid in cash, patents and property, and the capital of Henry Ford and Son is $1,000,000 paid in cash. Both firms have assets which are out of all proportion to their nominal capital, the Ford Motor Co., for instance, having cash on hand of approximately $125,000,000, to say nothing of its property and equipment worth on a replacement basis more than $100,000,000. The only stockholders in the new corporation are Henry Ford, Mrs. Henry Ford and Edsel Ford.

Columbia Axle Co., Cleveland, O., makers of one piece housing rear axles and front axles, have acquired the land and buildings of the Properties Co., which lie adjacent to their present plant and comprise 8½ acres of land, improved with two large factory buildings, one of four stories and one of two. This gives the Columbia Axle Co. immediately the use of 300,000 sq. ft. of floor spact. E. H. Parkhurst is vice president and general manager of the Columbia Company, and will continue in that capacity. W. R. Hopkins is president, Ben F. Hopkins is secretary-treasurer, R. E. Fries is chief engineer and general sales manager, and R. J. Goldie is factory manager.

Ford Motor Co.'s Milwaukee plant is to have an addition consisting of a two story building, 120 x 120, which will add 50 per cent to its assembling capacity. At the same time, approximately $1,000,000 will be spent in increasing the capacity of the tractor assembling plant at Kansas City, Mo. At the latter place, 4¾ acres adjoining the motor car assembling plant have been bought and plans made for buildings of 200,000 ft. of floor space. It is expected that 600-700 workmen will be employed and a capacity of 100 tractors a day reached.

Bridgeport Motor Truck Corp., Bridgeport, Conn., will place on the market a series of 1½, 2½ and 4 ton worm drive trucks. A daily capacity of 15 trucks is said to have been secured through the company's acquisition of the factory used for the production of Riker trucks while the war was in progress. Standard parts have been used throughout including Buda engine, Cotta transmission, Stromberg carburetor, Hartford automotive drive shafts, Spring Perch springs and Ross steering gear. R. D. Campbell is president of the organization.

Duesenberg Automobile & Motors Co., incorporated under the laws of Delaware, has bought a 16½ acre site on the outskirts of Indianapolis where a plant will be built immediately. Plans call for an output of 2,400 cars the first year. This will be a high grade car to sell at $6,000 or more, and will have many unique features. The motor will be an eight, with cylinders in a row, the car will have four wheel brakes, and a special axle, and will be 400 lbs. lighter than any car of equal power.

International Harvester Co., Chicago, has purchased a tract of 140 acres on the outskirts of Ft. Wayne, Ind., on which a truck plant will be erected immediately. It will cover about 12 acres, is expected to employ 1,000 and turn out 50 trucks a day. Subsequent additions will give employment to 2,000 more men. The Chamber of Commerce has agreed to provide homes to be sold the employees on reasonable terms, and has arranged for the building of a belt railroad to the new site.

Automobile Boat Co., 407 Shubert Building, Philadelphia, manufacturer of seaplanes and other aircraft, parts, etc., is having plans prepared for a plant near Audalusia Street, and the Pennsylvania Railroad. The factory will be one story, 250 x 500 ft., and will be equipped for manufacturing and assembling. E. S. Napolis heads the company.

Nash Motors Co., Kenosha and Milwaukee, Wis., plans a branch plant in England. Charles W. Nash, president, is leaving for England to establish this new unit. The company plans to build 65,000 vehicles in 1920-21, consisting of 45,000 cars from the Kenosha plant, 10,000 fours from the Milwaukee plant, and 8,000 trucks from the Kenosha unit.

General Motors Co. will locate two important plants on the 62 acre factory site in the Buchanan Street district, Grand Rapids, Mich., purchased early in the year as the start of its development of the property. One plant will be for the manufacture of Frigidair refrigerators and the other for the manufacture of the Sunny Home power plants.

Root & Vandervoort Engineering Co., East Moline, Ill., will separate the automobile and motor plants, running the two serarately hereafter. A. T. Miller has been made general superintendent of the entire automobile division, and Eugene Gruenewald continues as general superintendent of the commercial motor division.

Gardner Motor Co., New York, is being formed to succeed to the business and assets of the company of the same name, with plant at St. Louis. Russell E. Gardner will be president of the new company. A stock issue of over $1,000,000 is being arranged, the proceeds to be used in part for increased operations.

Orton Motor Co., Ltd., Petrolia, Ont., has been incorporated with a capital stock of $500,000 by Alfred Orton, Detroit, Mich.; Frank A. Halstead, Port Huron, Mich.; John Fraser, Petrolia, and others to manufacture motors, engines, machinery, tools, etc.

Gray Motor Corp., Detroit, plans an assembling plant at Milwaukee, where 100-150 cars a week will be turned out. This will be an independent corporation however. Other similar assembling units in various parts of the country are planned.

Red Diamond Motors, Atlanta National Bank Building, Atlanta, Ga., plans the erection of a large assembling plant. The concern has been incorporated with $5,000,000 capital stock. W. H. Seabrooke is president and Harry Short, secretary.

Winther Motor Truck Co., Kenosha, Wis., has broken ground for a new building, 60 x 400, for final assembly, painting and inspection. This is expected to double the capacity of the plant.

Mauson Motors, Ltd., Toronto, has been incorporated with a capital stock of $1,500,000 by Ernest M. Dillon, 49 Regal Road; Ray T. Birks, Room 50, 33 Richmond Street, W., and others to manufacture motor vehicles, engines, etc.

Patriot Motors Co., Lincoln, Neb., is considering a branch plant in the Southwest, probably at Houston, Tex. It is planned to increase the capitalization from $2,500,000 to $10,000,000 to provide funds for this addition.

Cleveland Automobile Co., Cleveland, plant additions started some months ago have been completed. This new building unit of brick and concrete construction, will be devoted exclusively to painting and trimming.

Magor Car Co., 30 Church Street, New York, manufacturerer of automobiles, has awarded a contract to William Hassen, Lawyers Building, Passaic, N. J., for a one story plant at Athenia, N. J., to cost about $30,000.

Geronimo Motor Co., Enid, Okla., plans the erection of an automobile assembling plant in Tacoma The bodies and tops of the cars will be manufactured in Tacoma, and the plant will cater to Oriental trade.

Ford Motor Co., Detroit, Mich., has awarded a contract to Horton & Horton, Inc., Dallas, Tex., for a local plant to be used for assembling, estimated to cost with equipment about $300,000.

General Motors Corp., Detroit Mich., is considering the purchase of a site at Baltimore for a new plant to be used for assembling and other operations for motor trucks and automobiles.

International Motor Co., West Front Street, Plainfield, N. J., is negotiating for property at Baltimore as a site for the erection of a new motor truck assembling plant.

Lewis Motor Mfg. Co., Fostoria, O., will soon call for bids for the erection of a new plant, one story, 50 x 300 ft. R. C. Lewis is president.

Mutual Truck Co., Sullivan, Ind., a Delaware corporation, has increased its capital from $50,000 to $5,000,000.

Revere Motor Car Corp., Logansport, Ind., will constuct a $200,000 addition to its plant in the fall.

Meteor Motor Car Co., Piqua, O., will increase its capitalization from $190,000 to $350,000.

Parts Makers

Fisk Rubber Co. has acquired the land and will erect a 25 story office building to occupy all of 57th Street, New York, between Broadway and Eighth Avenue, in the heart of Automobile Row. This new structure will replace two historic apartment houses popular in New York 25 years ago, the Rutland and the St. Augustine. The acquirement of the combined properties by the new interests gives them a frontage on 57th Street of 240.11 ft., 100.5 ft. on Eighth Avenue, and 54.3 ft. on Broadway. The plans for the building, which were filed by the architects, Carrere & Hastings and R. H. Shreve, estimate the cost of construction at $2,500,000, and a first mortgage building loan of $5,000,000 at six per cent has been underwritten by S. W. Straus & Co. The estimated value of the operation, including land and building is $7,500,000. The construction work is to be done by the firm of Fred T. Ley & Co., which is also one of the stockholders of the owning corporation, known as the 1767 Broadway Co., of which H. T. Dunn is the president. He is also head of the Fisk Rubber Co. Other stockholders include the Willys-Overland Rubber Co., The Willys Corp., and the Fisk Rubber Co. The new building will be the tallest of those structures north of the Times Square section, exceeding by five stories the United States Rubber Co. building which, at the time of its construction several years ago, towered above every other structure in its vicinity.

Detroit Steel Products Company's additions to the motor spring department at 2250 East Grand Boulevard make that company the largest motor leaf spring manufacturing concern in the world with a capacity of 1,920,000 springs a year, enough to equip 45,000 cars and trucks a month, or about 540,000 vehicles a year. A new forge shop and steel storage bins—242 x 65 ft. are included in the additions to the plant. The new forge shops will be equipped with the latest machinery, as the new spring forming machine that forms, quenches and hardens the leaf in a single operation, and makes an eight leaf spring each revolution, requiring about one minute.

Marlin-Rockwell Corp., 347 Madison Avenue, New York, will hold a special meeting July 18 to arrange for the sale of certain divisions of the company, including the radiator division, with machinery and equipment now in use; asbestos division, embracing all of the so-called Heany projects, with machinery and equipment, together with the plant on Willow Street, New Haven, Conn.; and the sporting goods division, including all business relating to the manufacture of firearms. Ralph A. Gamble is secretary.

Lewis Motor Mfg. Co., Fostoria, O., recently organized, has established a temporary factory and plans to erect a new plant. Ralph C. Lewis, formerly general manager Beaver Mfg. Co., is president; J. E. McMillen, formerly production manager Commonwealth Motors Co., is vice president; E. J. Bouchard, treasurer, and Joseph E. Krapp, secretary. The company will manufacture marine engines and expects later to make automobile motors.

William Cramp & Sons Ship & Engine Building Co., Richmond and Norris Streets, Philadelphia, has increased its capital from $6,250,000 to $20,000,000.

Gray Motors Corp., Detroit, has purchased the Gray Motor Co. for approximately $4,000,000. The latter corporation has been an established enterprise in Detroit for many years. F. F. Beall, formerly with the Packard Motor Car Co., is general manager of the new concern, and William H. Blackburn, formerly with the Cadillac interests, will be factory manager. The stock will be underwritten by New York and Chicago bankers.

United States Rubber Co., Broadway and Fifty-eighth Street, New York, has filed plans for a new plant at Hartford, Conn., for its subsidiary organization, the Hartford Rubber Works, specializing in the manufacture of automobile tires. It will be located on Park Street, and will cost $3,000,000, including equipment. An electric power plant to cost $264,000 will also be erected, as well as a building for employees to cost $402,500.

Evinrude Motor Co., 279 Walker Street, Milwaukee, which is erecting a new foundry and machine shop, 200 x 300 ft. on Atkinson Avenue, to be ready about Dec. 1, will manufacture, in addition to a gas engine motor set for rowboats and canoes, a farm oil engine. Inquiries and purchases of new equipment are being made. C. J. Meyer is president.

Ladish Drop Forge Co., Cudahy, Wis., which recently increased its capital stock from $300,000 to $700,000 has completed a five year building program and is now occupying a new shop, 80 x 300 ft. The power house has been doubled in size. The plant is employing 750 men in three 8-hr. shifts. C. L. Coughlin is vice president and general manager.

Body Builders

Ford Motor Co., Detroit, has selected Iron Mountain, Mich., as the site of a woodworking plant for manufacturing semi-finished and finished materials for passenger and commercial car bodies. A tract of 3,000 acres on the Menominee River at Iron Mountain has been purchased. A sawmill, planing mill and steam generating plant will be established immediately. Later buildings will be provided and equipped for the manufacture of complete bodies. E. G. Kingsford of Iron Mountain is in charge.

Central Auto Top Co. of Indianapolis, Ind., organized as a partnership in 1912, has been incorporated under the name of Central Auto Top & Leather Co. and will continue the same line of business and broaden its operations by the manufacture of leather products, such as belts, fan belt, automobile clutch leathers, leather specialties and belt repairing. The original company made automobile tops, victoria tops, seat, tire, radiator and hood covers, dust hood, door hand pads, back pads and repairing.

Limousine Top Co. changed its corporate name to Limousine Body Co., Kalamazoo, the capitalization has been increased from $200,000 to $50,000. Manufacture of tops has been discontinued and production is being confined to bodies exclusively. Work is progressing rapidly on the dry kiln being erected and will insure a larger supply of raw material for frames.

Irvin Robbins Co., Indianapolis, manufacturers of automobile bodies is completing a large addition to its manufacturing plant, the new building being 400 ft. long with one floor devoted exclusively to bench work. The company is also erecting a modern boiler house and is installing sufficient boiler equipment to provide for further enlargement.

Mullens Body Corp., Salem, O., earnings for the first six months of this year ran at the rate of $100,000 monthly after taxes. The company has recently declared the regular quarterly dividends of $1 on the common stock and $2 on the preferred, both payable August 1 to stockholders of record, July 17.

New Jersey Auto Painting & Body Co., and the Visible Gasolene Co., have been formed as two separate concerns by William B., Herman J. and Edward J. Glacken, with offices at Frelinghausen Avenue and Mitchell Place, to manufacture automobile bodies and gasoline measuring equipment respectively.

Edward G. Budd Mfg. Co., Twenty-fifth Street and Hunting Park Avenue, Philadelphia, manufacturer of steel automobile bodies, special steel stampings, etc., has arranged for a bond issue of $1,000,000 to be used for expansion. Its present plant totals about 850,000 sq. ft. Edward G. Budd is president.

Ideal Body Co., Madison, Wis., has been organized to manufacture open and closed passenger car bodies, truck bodies, cabs, etc The building formerly occupied by the Fox Motor Sales Co. at Madison has been equipped for quantity production of bodies.

Haynes-Ionia Co., has taken a contract from the Olds Motor Co. of Lansing for 12,000 auto bodies and increased production in its plant beginning August 1. The Ionia plant will also begin making closed car bodies for the Grand Rapids plant.

Smith & Patten Motor Sales Co., Defiance, O., has been incorporated at $200,000 and a second story will be erected to the plant now occupied by that company and will be used for the manufacture of automobile and motor truck bodies and tops.

McDermott Body Corp., maker of automobile truck bodies, has purchased the property at the southwest corner of Van Alst Avenue and 30th Street, New York, containing 20,000 sq. ft., on which it will erect a two story plant.

Bay City Auto Body Co. is now enlarging and remodeling its quarters. The company, which is a builder of commercial automobile bodies, expects to be producing two a day within the next few weeks.

Kaiserman Auto Top Co., 1408 Oxford Street, Philadelphia, manufacturer of automobile tops, has acquired a three story building at 642-44 North Sixteenth Street, for the establishment of a plant.

Atlantic Convertible Auto Body Co., Jamestown, N. Y., has been incorporated with a capital of $50,000 by J. T. Morrison, F. C. Congrove and J. D. Curtiss, to manufacture automobile bodies.

Detroit Weatherproof Top Co., Corunna, Mich., will soon call for bids for a one story plant, 100 x 565 ft., to cost about $200,000, for the manufacture of automobile bodies for closed cars.

Lorain Auto Body Co., Lorain, O., has been organized to manufacture automobile bodies and has acquired the plant of the Schill Pleasure Boat Co., Lorain. S. J. Wirtz is president.

Carvan Coach Works, New York, has been incorporated with a capital stock of $50,000 by J. C. Hines, A. H. Seymour and F. L. Weiliver, 43 Exchange Place, to manufacture automobile bodies.

Erdman-Guider Co., 2290 Woodward Avenue, Detroit, manufacturer of automobile tops, has commenced the erection of a one and three story plant, 30 x 130 ft. to cost about $75,000.

Mercury Body Co., Lexington, Ky., has been incorporated with a capital of $100,000 by C. E. McCormick, Guy Huguelet and L. G. Pulliam, Jr., to manufacture automobile bodies, etc.

Eastern Auto Body Co., Bridgeport, Conn., has completed plans for a new one and one-half story plant on Lindley Street, 60 x 90 ft. to cost about $35,000.

Automotive Trailer Corp., Springfield, Ill., has plans for the immediate erection of a new unit for the manufacture of motor trailers.

Index To Advertisers

WANTS

Wanted:—West Tire Setter No. 3, in good condition. A. E. Stevens & Co., Portland, Me.

For Sale:—Wheelwright and auto repair business, established over 25 years. Very conveniently located. Obliged to sell because of death of former owner. For particulars, address G. H. Blume, Railroad Ave., New Rochelle, N. Y.

WANTED

Foreman painter in first-class automobile factory in Boston, employing from fifteen to twenty painters on custom work; state age, experience and reference. Address Foreman-Painter, Automotive Manufacturer, 25 Elm St., New York City

WANTED—Mechanical draftsman or designer familiar with tractor or truck. Write giving age, experience and salary expected. Emerson-Brantinghan Co., 2723 University Ave., S. E. Tractor Works, Minneapolis, Minn.

PATENTS

Patents—H. W. T. Jenner, patent attorney and mechanical expert, 622 F St., Washington, D. C. Established 1883. I make an examination and report if a patent can be had and exactly what it will cost. Send for circular.

The Automotive Manufacturer

The Hub of Automotive Engineering

BODY BUILDING - AUTOMOTIVE PARTS - ALLIED INDUSTRIES

Vol. XLII, No. 6. NEW YORK, SEPTEMBER, 1920 $2.00 Per Year Issued Monthly

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The Automotive Manufacturer

The Hub ← A CONSOLIDATION OF → AUTOMOTIVE ENGINEERING

Vol. LXII NEW YORK, SEPTEMBER, 1920 No. 6

Dual Valve Motors in Expanded Pierce Truck Line

Conservative Buffalo Firm Expands Line of Trucks and Add Tractor, All Equipped With New Dual-Valve Motor, for Which Economy and Greater Power Are Claimed

FOLLOWING the precedent set in its passenger cars, the Pierce-Arrow Motor Car Co., Buffalo, N. Y., has adopted the dual-valve motor, so-called, for use on its motor trucks. Not only that, but the line has been expanded by the insertion of a 3½ ton unit between the 2 and 5 ton sizes, and has added a tractor. This gives a very complete line covering practically the whole range of heavy work. The addition of the dual-valve engine is said to give all of these units greater power, which is reflected in superior hill climbing ability, and also better fuel economy. In fact the Pierce Company claims 30 per cent more power, 50 per cent greater hill climbing ability, and 20 per cent more economy in fuel consumption.

These results have not been brought about by the additional valves alone, although the use of four valves per cylinder, two exhausts and two inlets has a tremendous influence. But this is materially increased by the use of double ignition, which gives two simultaneous sparks in each cylinder at the opposite ends of the combustion chamber. Through this combination the fresh charge of combustible gases is not alone greater than it would be with single valves, but is drawn in more quickly, and is ignited and exploded much more quickly. This makes for greater power, but is further increased by the double exhaust valves which permit taking out the burned gases more quickly and more thoroughly, so there is less dead gas left in the cylinder to dilute the incoming charge, in addition to which the cylinders are cooled better.

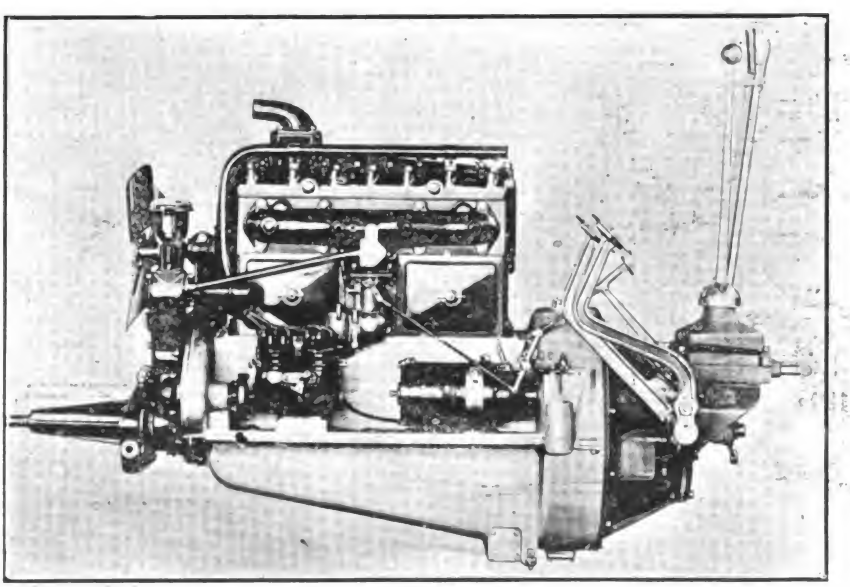
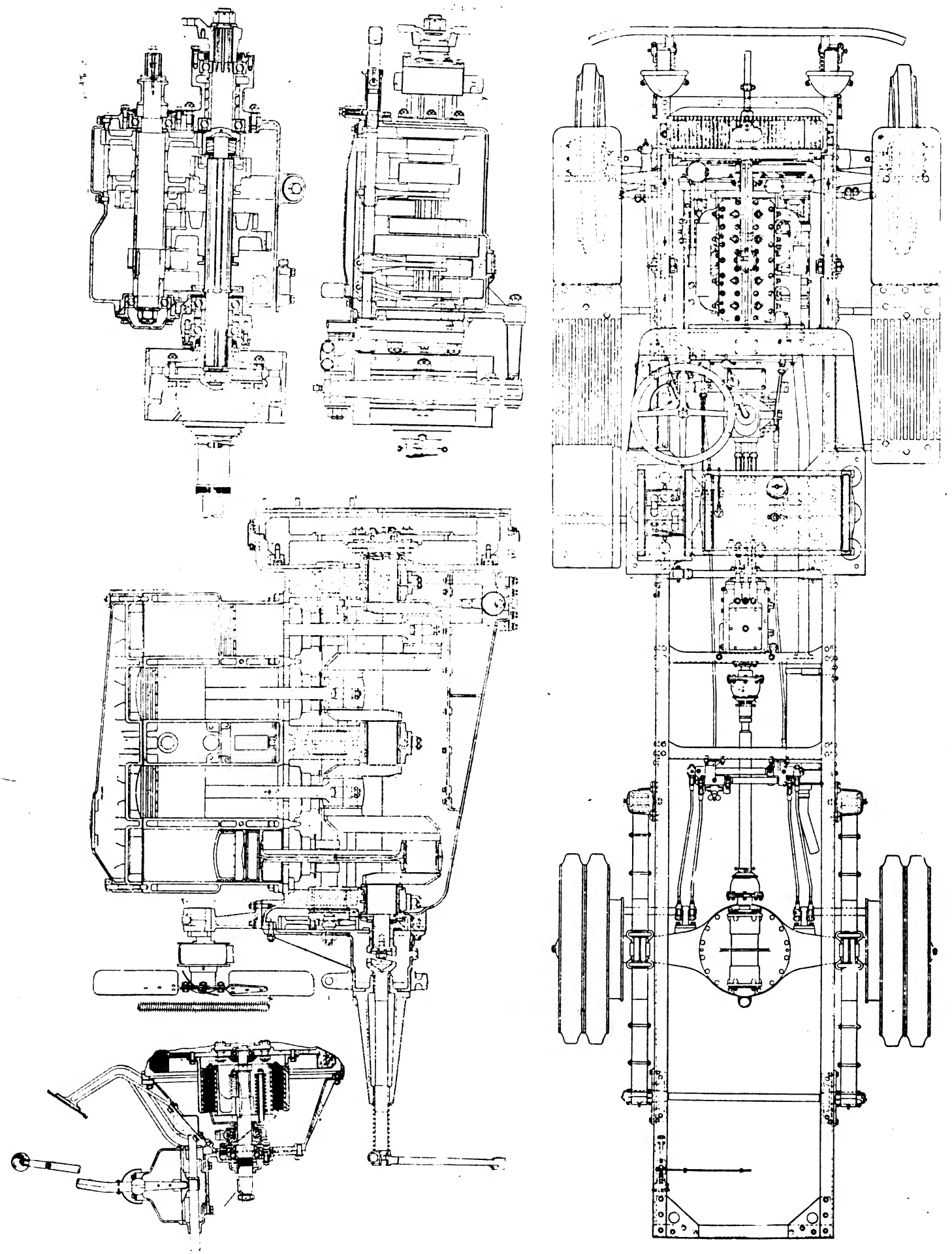


Fig. 1. Side view of the Pierce engine, which has four valves per cylinder and gives unusual power

Coming as it does after two years of continuous experimentation on the part of the Pierce Company, which had previously adopted the double valve motor for its passenger cars, after equally painstaking experiment and research, this may be considered as setting the final seal of approval upon this type of engine for all automotive uses.

While this is an epochal step, the trucks other than this follow accepted Pierce lines very closely, and the details of the tractor are not available. The 3½ ton truck described herewith shows no radical departure. It has the same general appearance as will be noted in Fig. 6, with the flexible frame, the same type of radiator with cast fins at the top, same shaped hood, same springing, same straight front axle, same worm drive rear axle, only the steering post showing slight changes. This steering post is set up at less of an angle with the vertical and the driver's seat brought forward slightly to compensate for this.

In general the unit power plant is located at the front end of the chassis, shown in plan view in Fig. 5, driving back by hollow shaft with two flexible joints to transmission located amidships. This gives four forward speeds and drives the overhead worm through hollow shaft with two universal joints one at each end. Rear axle is of the



Detailed drawing of some of the more important Pierce 3½ ton truck units. Fig. 1. (upper left) section through dry disc clutch. Fig. 3. (upper center) longitudinal section of engine showing crankshaft and bearings. Fig. 4. (upper right) the four-speed transmission in plan and elevation. Fig. 5. (lower) plan view of the complete chassis, showing disposition of units

full floating type with wheels on Timken taper roller bearings. Semi-elliptic springs are used both front and rear, the fronts shackled at rear end only and the rears at both ends. This model is made in two wheelbase lengths, 13 ft., 6 in. standard and 16 ft., 6 in. long. The former will take a body up to 12 ft. in length and the latter an extra long body up to 15 ft. long.

The engine which is shown in the external view Fig. 1, longitudinal section, Fig. 4, and cross section Fig. 7, is of the four cylinder T-head type, with 4½ in. bore and 6¾ in. stroke. The S. A. E. horsepower rating is 32.4, but at the governed speed of 1,200 r.p.m. it will develop about 60 horsepower under normal conditions. The four cylinders are cast in a block, and have removable cylinder head. This makes the valves and combustion chambers more accessible, and permits of keeping the vehicle in better running condition through easier carbon removal The dual valve operating parts are entirely enclosed by four cover plates held in place by large wing nuts. Valves are automatically lubricated from the crankcase and may be easily adjusted by removing the covers. Crankcase is of cast aluminum with supporting feet on the largest diameter enclosed. Gear shift and brake levers are mounted on the removable clutch housing as are also clutch, brake and accelerator pedals. This arrangement makes a particularly neat compact control group.

Cooling is by water, circulated by centrifugal pump, with thermostat mounted on water outlet of cylinder jackets. Vertical finned tube radiator with cast upper and lower tanks is mounted at front end of chassis on projecting radiator feet, with spring beneath each bolt to allow frame flexure without stressing the more delicate radiator. Beneath the radiator feet are fabric pads also.

Large diameter, four-bladed pressed steel fan mounted on adjustable roller bearings is driven by belt from crankshaft pulley. Ignition is by Delco-Pierce double spark system, including generator and storage battery to provide current for both ignition and electric lighting. There are two sets of contacts, distributors and coils acting in exact synchronism and providing two simultaneous sparks in each cylinder. The battery is a special heavy duty type, designed for truck service. Carburetion is by special Stromberg Model M-3 carburetor mounted on short inlet manifold attached to cylinder casting. All air is pre-

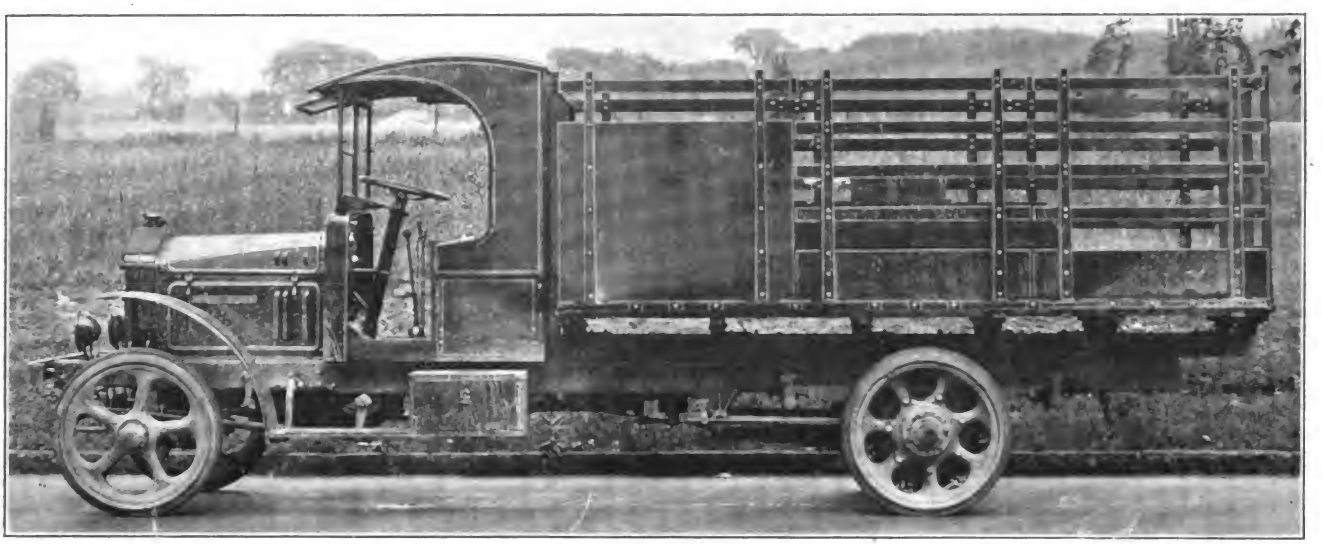


Fig. 6. Side view of the new Pierce 3½ ton truck with body

of the flywheel housing. Forward from these a shelf extends along either side, upon which are mounted the accessory units, water pump and generator on right side, ignition distributor and starting motor on the left side. This arrangement distributes the units so that all are more accessible.

The engine suspension is three point, two points at the rear by crankcase arms as just mentioned, and a forward point, consisting of a large diameter trunnion on the front end of the crankcase, this forged steel unit being bolted to the side frame brackets by a single bolt on either side. The rear end arms also rest on frame brackets with fabric pads between to cushion vibration.

The crankcase is large size, is mounted in three main bearings of liberal size. Connecting rods are of heat treated special alloy steel forgings, with ample bearing surfaces. Both crankshaft and connecting rod big end bearings are bronze lined with hard white babbitt, reamed to accurate size and alignment. Camshafts are one piece forgings with integral cams, mounted in bronze bearings and driven by silent gears at the forward end. The governor of the independent centrifugal throttling type is heated by exhaust manifold passing through cylinder block. A hot weather air regulator is provided. Lubrication is of the full force-feed type, with geared pump in the bottom of oil sump supplying oil to all bearings and gears under pressure. Double strainers permit using the oil over and over without danger.

As in all other Pierce trucks, final drive is by worm gear, with worm mounted above the gear in a central housing of the bowl type. This is a heavily ribbed steel casting, into which alloy steel tubes are shrunk and pinned, these tubes supporting the road wheels. Forged steel brake supports are bolted to the flanged steel sleeves fittings on the axle tubes and bolted to the axle housing to provide ease of disassembling. Axle shafts are heat treated steel of generous diameter, splined at both ends. Worm and worm wheel are mounted on large ball bearings with special heavy self-aligning thrust bearings to take driving stresses. Differential is of the spur gear type, mounted within the worm gear and flooded with lubricant.

Internal expanding brake shoes are supported on forged bracket bolted to sleeves on axle tubes, these sleeves also carrying the spring seats. Brake drums are heavy steel

driven from the front end of the inlet camshaft, with all levers and connections entirely enclosed.

Clutch is mounted with the flywheel housing, and is of the multiple dry disc type. Working parts are entirely pressing bolted to wheels and flanged to resist distortion.

Frame is of heat treated pressed channel section steel, tapered at the forward end, as Fig. 6 shows. Brackets carrying bumper and front springs are bolted to extreme forward end. There are four cross members, a light one at the front end, largest and heaviest directly under the driver's seat, the rear support for the transmission, and that at the extreme rear end. These can be seen in the chassis plan, Fig. 5.

Steering gear is of the semi-reversible screw and nut type, located on the left side. Column is inclined at a slight angle and braced to the dash. Wheel is 20 in. in

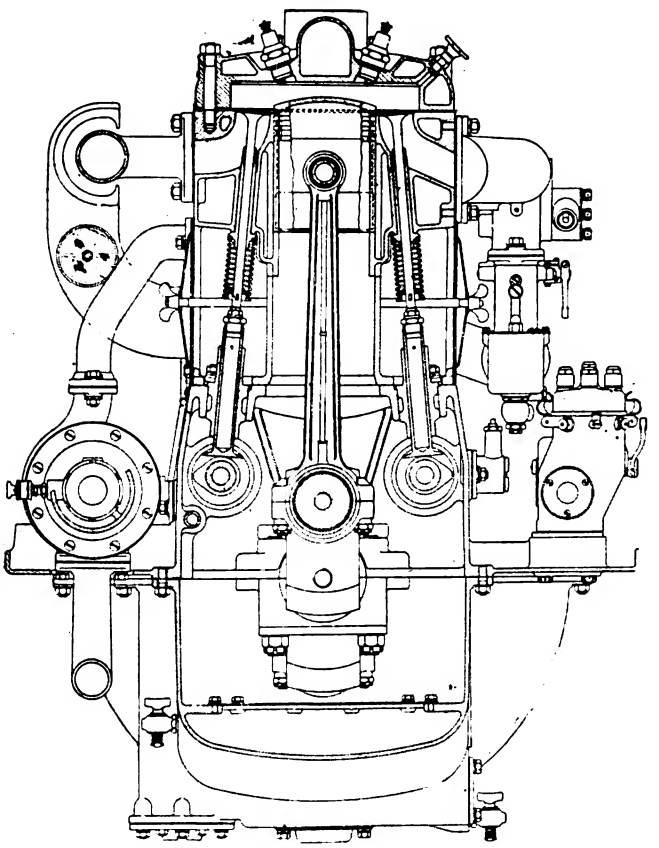


Fig. 7. Cross section of the new dual-valve Pierce truck motor which develops 69 horsepower against a rating of 32.4

diameter, this extra large size giving easy and comfortable control of the vehicle.

Speed with standard solid tires is 16 m.p.h., and with 44 x 10 pneumatic tires 22 m.p.h. In this latter combination, the governor is set at 1,350 r.p.m. Other details will be apparent in the illustrations.

Canada's Tariff

A commission to revise the tariff of Canada began sessions in Winnipeg Sept. 15, and after the opening meeting the commission proceeded to British Columbia to take evidence on the Pacific coast. The commission consists of Sir Henry Brawton, minister of finance, chairman; J. A. Calder, president of privy council, and Senator Robertson, minister of labor. Hearings will be held at many cities between the Pacific and Atlantic.

Successful Year's Flying on London-Paris Route

Mr. Holt Thomas, in the course of a letter to the Times, (London), on August 25, dealing with a year's running of the "Airco Express," and pointing out that out of 1,535 flights scheduled 1,444 were completed, states: "Although the air route between London and the Continent is one of the worst, climatically, in the world, only 83 air journeys during 323,355 miles of flying were prevented by weather. This should not, by the way, be taken to mean that flying was prevented altogether on as many as 83 days. Half a dozen machines are often scheduled to depart at various times during the day; and whereas weather conditions may cause a flight in the morning to be abandoned, it may be found perfectly feasible to get machines away during the afternoon. Thus even on a day when the weather is very bad, only one, or perhaps two, flights out of say six, need be cancelled.

"It has been argued that the aeroplane is a frail vehicle, unreliable mechanically. Well all one need say in this respect is that less than six of the 1,535 scheduled flights were prevented by mechanical defect, and only about 30 interrupted through any compulsory descent while en route; and in the case of such landings, as a result of mechanical trouble, the delay has as a rule been very slight indeed.

"When I started this London-Paris service I ventured the prediction that in our first year's flying we should attain about an 80 per cent efficiency. Actually it works out in round figures, at 94 per cent. One is justified therefore in saying that flying at 100 miles an hour is already commercially practicable."

Making Wood Fire Resistant With Paint

Fire retardent paints are the most practical means so far discovered by the Forest Products Laboratory by which small amounts of wood can economically be made fire resistant. The only other known methods of decreasing the inflammability of wood are to keep it wet, or to inject into it certain chemicals under pressure. These methods, though more effective than painting, are usually either impracticable or too expensive to be considered.

Ordinary calcimine or whitewash has proved in tests to be as fire resistant as any paint covering tried. It is cheap and conventient to use. Although it will not prevent the burning of wood exposed continuously to a high heat, a good coat of calcimine on wood will decrease the danger of a blaze spreading from burning cigarettes, sparks, matches and similar small sources of fire. Calcimine is of course more effective for inside than for outside use.

For exterior use numerous patented fire retardent paints are available. An effective outdoor paint which has been developed at the Forest Products Laboratory consists of linseed oil, zinc borate, and chrome green. This paint has maintained its fire resisting properties through more than three years of exposure to the weather.

An aerial mail service has been established in New South Wales, Australia, connecting Lismore, Casino and Tenterfield. The initial flight with the landing at Casino took 75 minutes. The distance by road is 100 miles. through one of the most beautiful and wealthy sections of the entire Australian continent.

Big Scale Home Building by Motor Corporation

Elaborate Methods of Solving Housing of La bor Problem as Worked Out by General Motors Corporation at Flint, Mich.—Types of Buildings Constructed—Materials Used

ONE of the biggest problems which all manufacturing industries have had to face in recent years is that of housing accommodations for their help, that is, modest homes for all forms of labor. Those industries which have been particularly and unusually busy have found this to be a most unusual problem, and one that required their best brains and a great deal of time and money in solution. And it had to be solved, as without housing there could be no increase in working forces, without additional labor there could be no expansion, to go without expansion under rapidly increasing prices all around was to stand still or lose ground.

The automotive industry was particularly hard hit in this respect, as it showed an almost universal demand for a 50 per cent increase in output during 1920 as compared with 1919. The latter year too showed almost as heavy a gain over 1918. The way in which one large automotive company, General Motors Corp., handled this delicate situation at Flint, Mich., is fully described by Chester Shafer in the American Carpenter and Builder.

In the construction and practical completion of a city of 950 homes in less than a year the Du Pont Construction Company of Wilmington, Del., serving for the General Motors Co. at Flint, Mich., has shown the method for coping with a difficult housing problem. Starting on May 1, 1919, the houses were completed in the main, by Dec. 1, being fitted with water, gas, sewer and electrical connections. Some minor details held up by cold weather, and a few stretches of paving remained to be completed. By April of this year the homes were occupied by employees of the General Motors Co., who will handle the costs, ranging from $3,000 to $7,000 on a time-payment plan.

Standardization of operations allowed for the rapidity of work on the project. Each job was organized into a department. Each department had its foreman and its regular gang of workmen. One department did the rough framing, another the exterior trimming, while a third did the interior trim.

Painting, plastering and all other operations were handled in the same way, thus giving experts and experienced workmanship on all details. Thirty types of houses were erected.

The streets in the project are of asphalt. Storm and sanitary sewers are provided. In pouring foundations placing plants were set up so that one plant covered two houses. In this way two houses were poured and the mixer moved and set up again in thirty minutes. All material for the job was hauled over a narrow gage railroad. At the height of the job twenty miles of the road were in use. A maximum haul of three miles was registered over grades as steep as two and one-half per cent on the main line. Both steam and gas locomotives were used. The road pouring work for the pavements was done with batch boxes on narrow gage cars. But eleven men were required around a mixer.

For the cellar foundations excavators with light drag lines were used. Steel forms were set for the foundation walls and placing plants were operated.

The curbings and sidewalks were all poured from the batch boxes used on the narrow gage cars.

The narrow gage lines were constructed in every street and materials were hauled to the very point of usage. Locomotives were used to a large extent on the narrow gage. The batch boxes were of three-ton capacity.

After much investigation it was decided to build five types of houses; four-room bungalows with two bedrooms, a living room, kitchen and bathroom; five-room bungalows and houses with two bedrooms, dining room, kitchen and bathroom; six-room bungalows and houses with three bedrooms, living room, dining room; seven-room houses with four bedrooms, and eight-room houses with five bedrooms, living room, dining room, etc.

Each house is equipped with electric lights, a hot air heating plant, gas range, and gas hot water heater. All houses were papered by the contractors.

An unloading yard was maintained about two miles from the job at the connection of the narrow gage with the broad gage. Here most of the work was done that permitted of swiftness of operation on the project. A number of saws cut all lumber used into proper lengths as soon as it was unloaded.

This sawing was always done by the same men and it was accomplished in fast time. The cut lumber was then hauled to the project and was ready for immediate use. All difficult framing such as porch roofs was done at the yard also. A regular gang of carpenters achieved this work and prepared the pieces for fitting. Several small saws were set up on the project for emergency work, but ninety-nine per cent of all sawing was done at the yard. The construction gangs were thus provided with material without loss of time on detailed work.

At the unloading yard the gravel and cement for the foundations were mixed with the minimum human labor. An unloading crane transferred the gravel from broad gage cars to bins. The bins, erected over a narrow gage spur, were used as mixers. After the cement had been dumped in the mixture was released into narrow gage cars and hauled to the project, where it was all ready for use in the final mixer. The services of one man on the crane and one man to dump in the concrete were all that were required to complete the initial mixing process.

Several novel ideas were always in evidence on the project. During the winter, for instance, when the outdoor work was disagreeable, canvas houses were built around the houses which were being erected. These "kimonos" permitted work with plaster and concrete. Stoves set up in the intervening space kept the atmosphere warm. This gave comfort to the workmen and made the use of the material possible.

The success of the project is liberally attributed to the engineers and the advanced ideas of standardization.

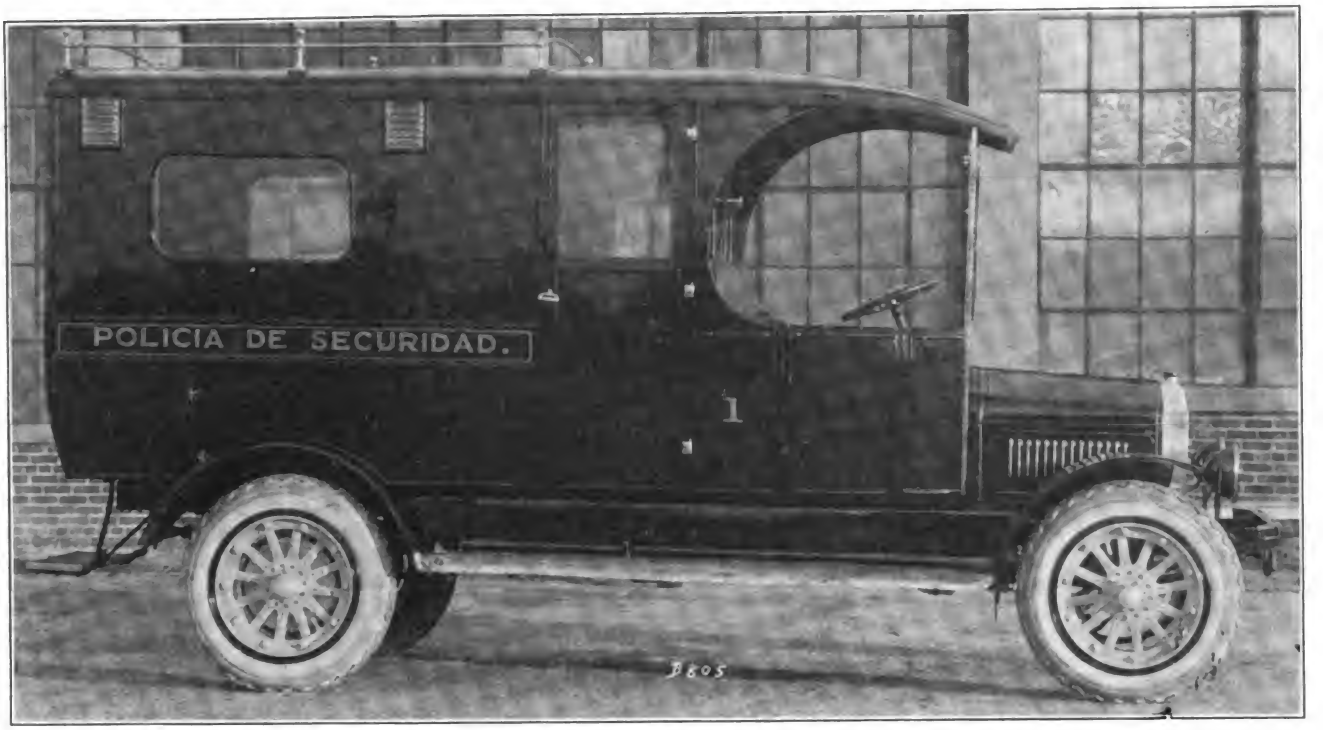
Motor fuel may be produced in Hawaii as a process has been patented which uses molasses and the waste of pineapple canneries. It is said more than 10,000,000 gals. a year could be produced from these materials.

Widening the Field of Utility of the Motor Truck

There is no finer work which motor vehicles can do than that of hospitals. The pictures on this page show a special portable first aid dressing station, two of which (constructed on Pierce-Arrow 2-ton truck chassis) have been attached to the Commonwealth Emergency Hospital, Boston

The view at the left shows the front compartment, which is divided from the center one by a sliding door in a sliding steel partition. It contains wash bowl with running water furnished from vertical tanks which also furnish hot water for sterilizing, shelf for hot coffee, and many other shelves for surgical and medical instruments

The center compartment is the dressing or operating room, sufficiently large to treat six persons at a time. The rear compartment, shown in the view below, has two folding bunks. When the operating table is not in use it can be folded into this bunk space. Besides overhead lighting from a large dome, plugs on the side permit the

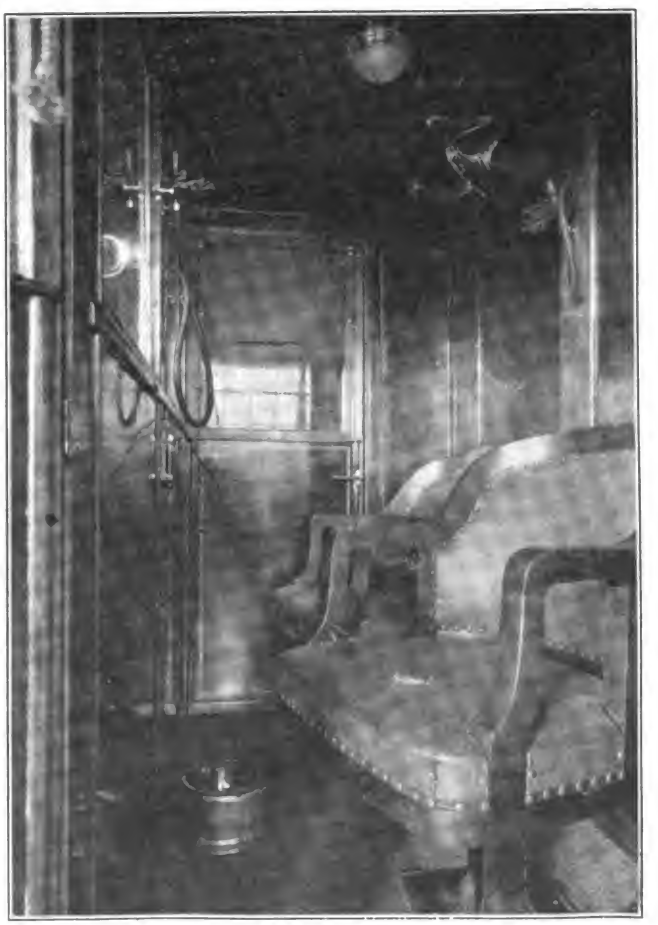


use of portable lights. Each vehicle has a crew of seven, driver, two physicians and four nurses

Almost as desirable a field of civic activity for motor trucks is that of police, fire and similar work. The vehicle shown on this page is a very elaborate police patrol, built on a Garford 1¼-ton chassis for the officials of La Paz, Bolivia. Like the first aid vehicle, it has three compartments

Directly back of the driver's compartment is that for the chief of police, shown below at the right. This has interior metal trimmings of nickel, electric cigar lighter, handsome mahogany swivel chairs, upholstered on blue leather, carpets of a handsome blue, and fancy windows draped with curtains to match upholstery and carpets

The prisoner's compartment at the rear has no such luxury. This, shown below at the left, has longitudinal wooden seats, rubber matting on the floor, and rings on the wall to which unruly prisoners can be handcuffed. All comparments are enclosed and electrically lighted. The exterior is painted a dark blue. A highly polished aluminum radiator adds to its impressive appearance. The side view of the complete vehicle, shown above, gives a good idea of its size, and shows particularly the large door to the chief's compartment



Greater Efficiency in Centralized Gear Making

Great Size of One American Automotive Corporation Warrants Central Specialized Forge, Gear, Axle and Power Units—Complete Description of Gear Plant

PRODIGIOUS is the best word with which to describe the present size and scope of the automotive industry and its widely radiating influence on our whole economic and business life. Many people in this country and the vast majority in other countries fail to appreciate the magnitude of the industry and its ramifications. The fact that one company in this industry has grown to such an extent as to warrant separate enormous specialized plants, located in those parts of the country which are most advantageous, this including engine plants, clutch plants, steering gear plants, forge plants, axle plants, body plants, gear plants, power plants and others, with a description of one of these, the gear plant, may serve to indicate the industry's enormous size and tremendous resources, together with an idea of the stability of the industry, and the confidence of its leaders in the future.

Reference is had to the General Motors Corp., which acquired a very large tract of land on the northern outskirts of Detroit, several years ago to provide for centralized production. On this three large independent manufacturing units have been constructed and are in operation. These are the Central Forge Co., the Central Axle Co., and the Central Gear Co. In addition another central plant is being erected for the building of motors, and a large central power plant has been built under the name of the Central Power Co. for the distribution of electrical power to the various units and for supplying steam for heating the buildings and for operating the hammers in the forge shop and other power purposes. The various units are designated as divisions of the General Motors Corp. and these have recently all been grouped together as units of a new organization known as the Central Products Co.

The latest addition to the group to be placed in operation is the plant of the Central Gear Co. In this plant differentials are made for the various car building units. The work includes the manufacture of both straight tooth and spiral bevel gears, for internal gears and main drive gears and pinions, the machining of gear housings and assembling the gears and housings. With its arrangements for continuous production on a quantity basis the gear works is an unusually interesting example of the modern type of plant designed for large production.

The gear manufacturing plant includes a machine shop 600 ft. long and 360 ft. wide fronting to the south, and a heat treating building 360 ft. long and 100 ft. wide. The latter is located at the rear of and at right angles to the machine shop, the ends of the heat treating building being in parallel line with the sides of the other building. The two buildings are separated by a paved court 40 ft. wide. On the west side of the plant where the bulk of the raw material is received and the finished differentials are shipped out is a receiving and shipping platform. This extends the full length of both buildings and at the side of the connecting court, a total distance of 740 ft. Another platform extends along the north side of the heat treating building and railroad tracks run the length of both platforms. These tracks have connections with both the Michigan Central and Grand Trunk railroads. The tracks are sufficiently depressed to bring the car floors on a level with the loading platforms. The platforms are 16 ft. wide and have asphalt block floors. They are covered the entire length by canopies extending almost the width of the platform and electric lamps are suspended in the canopies. The machine shop has eight double steel doors 10 ft. wide along the receiving and shipping docks. Extending across the front of the plant and connecting to the machine shop is a two story office building 360 ft. long and 30 ft. wide.

Fig. 1. View down the Central Gear Co.'s plant through the center aisle. The left side is devoted largely to primary operations. The gears are cut and ground on the right side. As a rule each bay is a separate department. Work is routed across the plant, starting at the stock receiving side

Fig. 2. Department in which gears and pinions are blanked. This as well as other departments in machine shop are all in one large well-lighted room

The machine shop is a saw tooth type of building of brick, steel and glass construction. The windows are reinforced factory glass set in steel sashes. The building is divided into transverse bays by building columns 8 x 10-in. I-beams, placed on 30 ft. centers, the rows of columns being 40 ft. apart lengthwise of the building. The distance from the floor to the bottom of the saw tooth roof is 15 ft. The floor is of 1¼ in. maple laid on 3 in. tar rock under which are 10 in. concrete slabs, the slabs being supported on piers. The building site was originally a swamp and dump, and the piers which extend down to the solid earth were necessary to provide a firm foundation. The floor is provided to carry a live load of 600 lb. per sq. ft. The roof is of cast gypsum.

The two outside bays lengthwise on the east and west sides of the building for a width of 40 ft. are partitioned off by a 10 ft. wire screen and are occupied by various departments other than production departments. On the west, or receiving and shipping side, are rooms for bar stock and other rough stock (see Fig. 7), tool cribs for the men working in that section of the plant, shipping department and offices of the superintendent and production manager, these offices being located near the center. In the east bay are the electrical repair, shop maintenance, shop supply, cutter and tool grinding departments, inspector's office, main tool crib (see Fig. 6), tool room and wash and locker rooms. The latter named rooms are at the southeast corner and adjoining the factory entrance, which is from the front through the east side of the office building. In connection with the wash and locker rooms there is a section filled with tables where the men eat their lunches if they do not care to patronize the cafeteria that is provided in a separate building located between the gear plant and that of the Central Axle Co.

Practically the entire machine shop with its large floor space is all in one room, the small sections of floor space on one side occupied by the offices of the superintendent and production manager being the only parts entirely inclosed outside those that are screened in. The wash and locker rooms are separated from the main floor by solid metal partition, which however is only 10 ft. in height and interferes little with the light and ventilation.

A feature of the plant is the convenient arrangement of the bar stock room, which is so constructed that stock

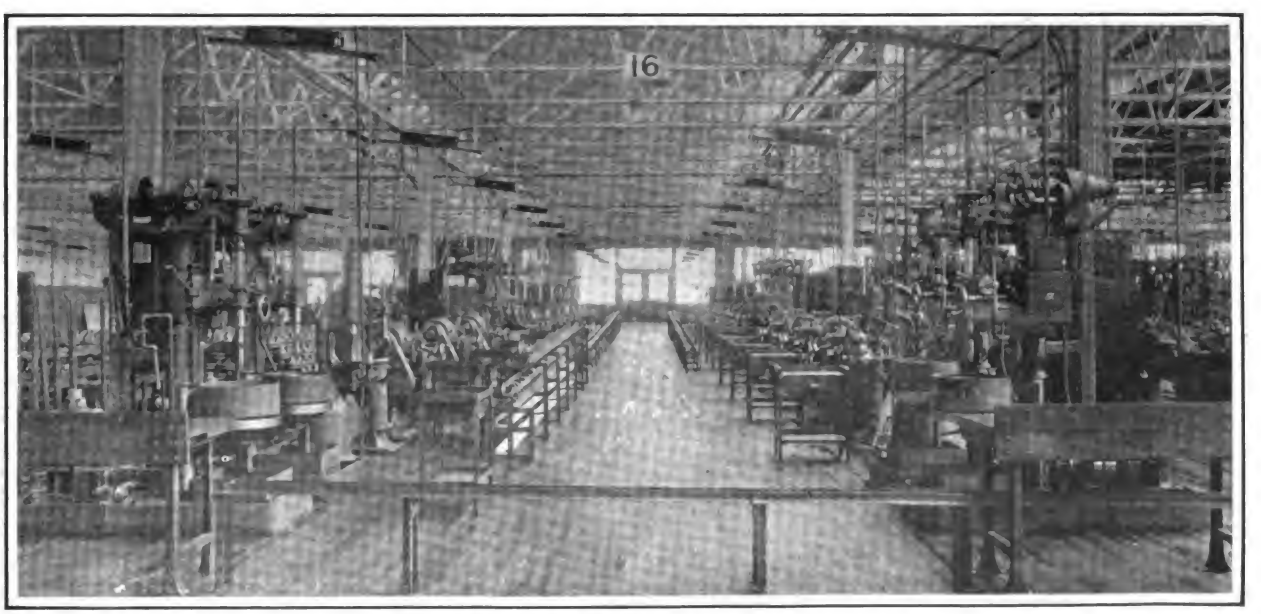


Fig. 3. Differential cases are machined in the bay shown in this and the illustration below. Machinery is laid out for continuous and consecutive operation

Fig. 4. The two illustrations on this page show some of the runways for handling the work and the method of designating the departments in bays by numbers

is placed in the bins directly from the outside platform where it is unloaded. The stock bins are 90 ft. long, 20 ft. wide and 15 ft. high, and are divided into three 30-ft. sections. Back of each section is a roller lift door and when stock is to be placed in the bins one of these doors is rolled up, opening the back end of the bin at the side of the platform. There are similar rolling doors at the front of the bins and these are let down when the weather is cold, thereby preventing a draft of cold air coming from the bins into the machine shop.

In addition to the roller doors, sliding wood bumpers are provided along the front of the bins and these prevent the stock being pushed too far inside when the bins are being filled. Each inside and outside rolling door is raised and lowered by an electrically driven operating device, the motor and operating equipment being located above the door and controlled by a push button at a convenient reach from the floor.

The stock bins are 24 ft. wide and 30 in. high. They are built of 6-in. upright channels spaced 24 in. apart, and to these are bolted 3 x 3 in. angles which support 20 lb. rails, the rails forming the bottom of the bins.

The machine shop is divided longitudinally into two division, one division being located on each side of the main 10-ft. center aisle. There are also two outside aisles 8 ft. wide between the screened-in departments and the production departments. Each division is under the direction of an assistant superintendent. The first division on the receiving and shipping side is used almost wholly for primary operations. The gear housings are machined and finished complete in this division, but here work on the gears is limited to the blanking operations (see Fig. 2), and to other machine work up to the cutting operations. In the second division, or in the half of the plant across the center aisle the gears and pinions are cut and ground, (Figs. 3, 4 and 5).

Fig. 5. Gear-grinding department. All machines are driven by individual electric motors, as shown, with the consequent elimination of all overhead belting

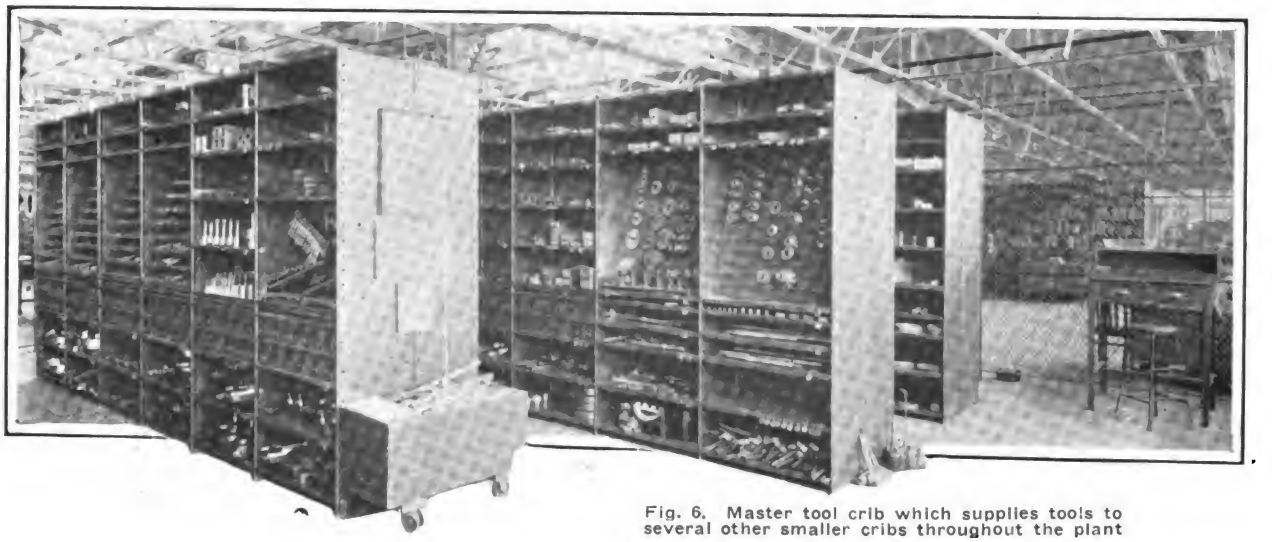


Fig. 6. Master tool crib which supplies tools to several other smaller cribs throughout the plant

The plant is subdivided into 39 production departments. With the various nonproduction departments located in the outer bays there are 56 departments in all. The production departments occupy traverse bays which are 135 ft. long to the center aisle and 30 ft. wide. Two rows of machines are placed in the bay with their backs toward the building columns leaving a wide aisle in front of the machines. Incline runways of steel construction are provided in front of the machines for handling work along the line of machinery, these being used for housings and other parts that can readily be moved in this way. In the differential housing department a runway is located in the aisle to take housings from one department to adjoining departments.

As a rule, each bay is a separate department, but a few departments take two bays and in some cases work is done on three or four pieces in one bay. Generally speaking, work is routed across the plant starting with the first division on the stock-receiving side. All machinery in the various departments in this primary operation division is laid out for continuous and consecutive operations, the machines being arranged in proper order for successive operations on certain parts rather than the grouping of machines of a similar type for similar kinds of work on different kinds of parts. The machine tools are single-purpose machines, and 80 per cent of them are either automatic or semi-automatic in their operations. When a set-up is made on a machine that set-up remains as long as the shop has orders for that particular part.

The plan of machinery arrangement for consecutive operations is not followed in the second division or on the gear-cutting side where the machinery is arranged in two separate groups, one for rough cutting and the other for finished cutting, since it was belived that better results could be obtained in the gear cutting department by segregating machines according to type rather than to have them arranged for successive operations. After the finished cutting the gears go to the heat treating department

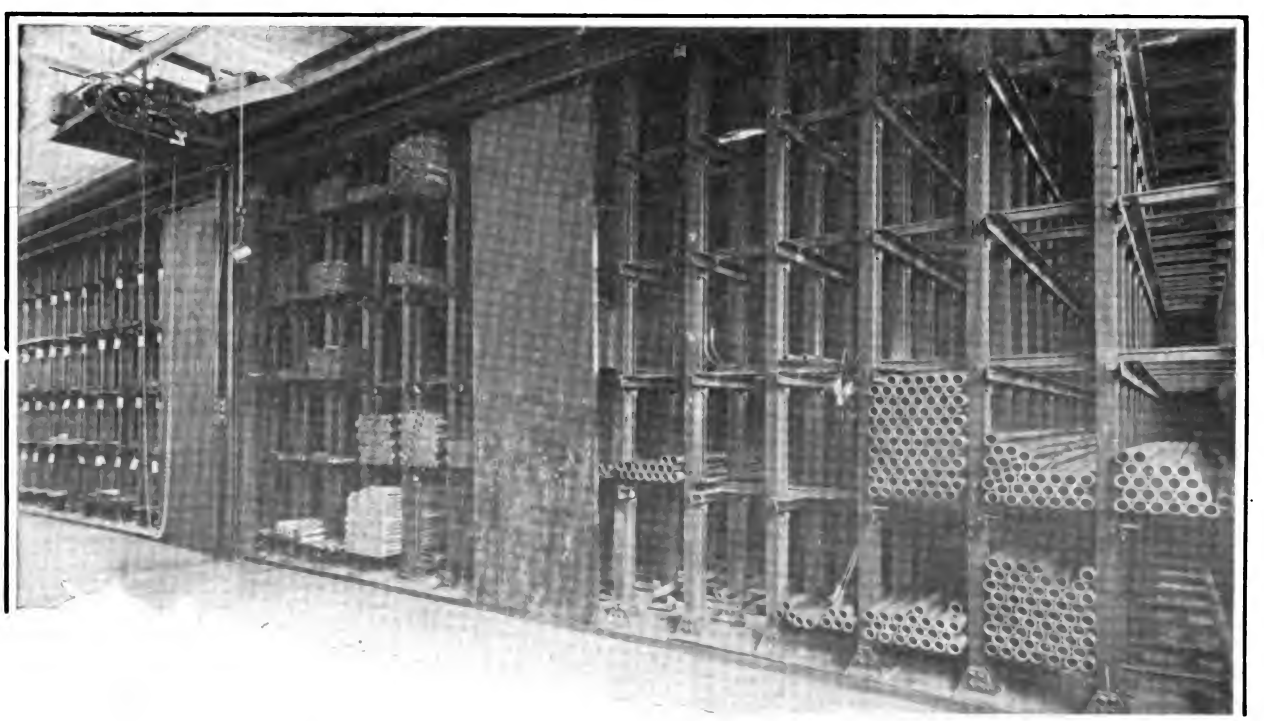


Fig. 7. Steel stock bins. Stock comes in from the back where there are roller doors along the unloading platform. An electrically operated device for raising and lowering the roller doors in front of the bins and the sliding wooden bumpers is shown in the upper left corner of the illustration

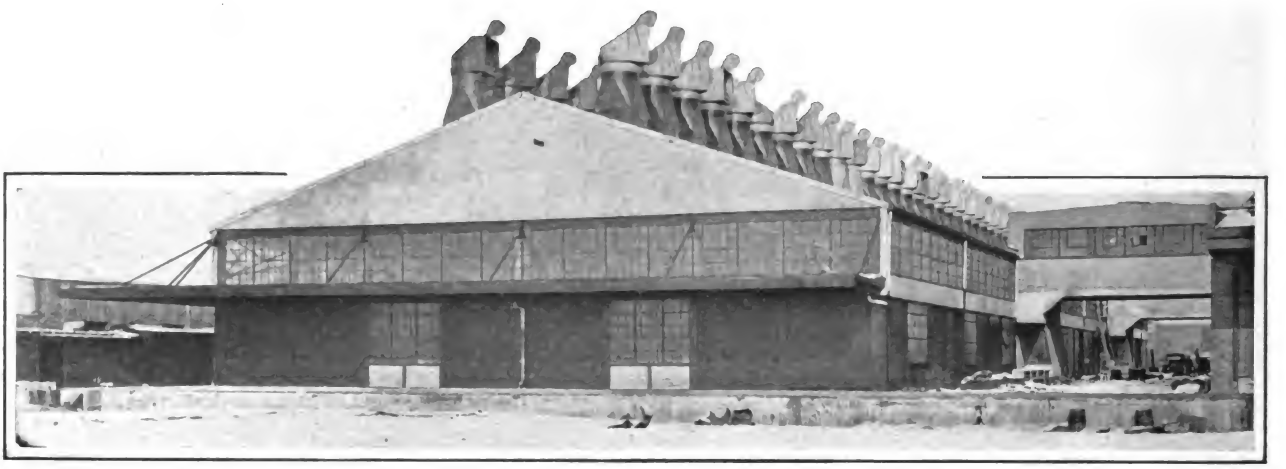


Fig. 8. This shows the design of heat treating building and the location of overhead toilet rooms in the court between this building and the main building

and from there back to the grinding department. From there they move to the finished stock room that occupies a section of the main floor near the front of the building. Assembling is done in an adjoining bay between the finished stock room and shipping department.

There is a 100 per cent floor inspection of work, the parts being inspected after every operation that warrants an inspection. Consequently the only final inspection is the one made after the last operation.

All the machinery in the plant, which includes 850 machines, of which 300 are gear cutters, is driven by individual motors; consequently all overhead belting is eliminated. Energy is supplied to machines through overhead conduits extending down from the roof trusses. All motors of 5 h.p. ratings and less have push button control. The provision made for electrical repairs suggests fire department methods. Should a motor get out of order an annunciator calls a crew of men from the electrical repair department and they hurry to the scene with an electric tractor painted a bright red and especially fitted up for this purpose and completely equipped with tools and repair parts, and repairs are made at the machine with a minimum amount of delay. Electrical energy is delivered to the plant at 4,600 volts and to the machine through three banks of transformers at 440 volts.

Electric tractors are generally used for conveying work throughout the plant, these being of the elevating platform type for picking up racks and tote boxes. This transportation system is supplemented by hand trucks with elevating platforms for very short hauls. The machines are provided with individual metal tool stands and have drawers and locks. All shop bins and tool cribs, lockers, etc., are of metal.

The side walls of the building and columns are painted green to a height of 6 ft., and above that the entire interior, including the roof trusses, is painted white. This, together with the abundance of window surface in the side walls and roof, makes the interior appearance of the building unusually light, bright and clean. Each department is designated by number, which is painted on each side of a sheet metal square suspended from the roof trusses in the aisle at the head of each department, so that the number of the department can be plainly seen from every direction. Artificial light is provided by two rows of Cooper-Hewitt lamps in each bay. The same method of lighting is used in the heat treating department.

Four toilet rooms overhead, reached by iron stairways, are provided in the machine shop. Each of these is 30 x 40 ft., or the size of one bay, and take the place of a section in the saw tooth roof. The heat treating department has two toilet rooms which are built of steel and concrete over the court between the two buildings. These

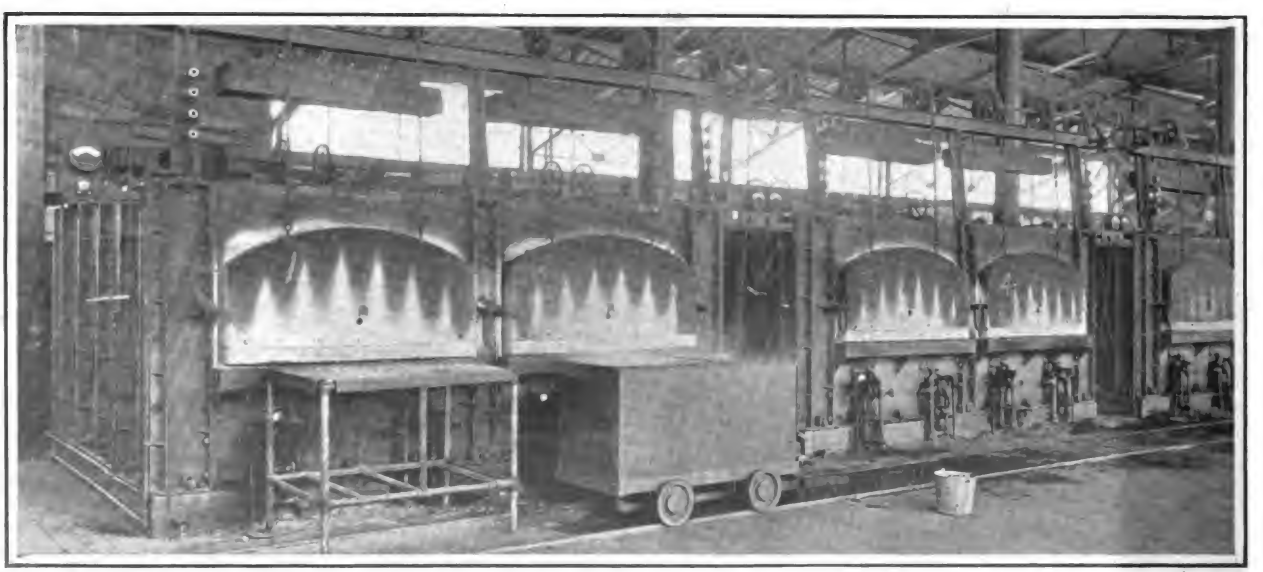


Fig. 9. Carbonizing furnaces in the heat treating department. Carbonizing pots are unloaded on the table and dumped into a portable quenching tank which is equipped for connection to the oil circulating system and water pipes in the tunnel beneath the track

have shower rooms in connection. The machine shop has a fully equipped first-aid hospital located in the office building.

The heat treating department is located in an unusually well-lighted building of steel construction, the general design of which is shown in the accompanying exterior view, (Fig. 8). There are continuous window sections on the four sides, and beneath these are roller steel doors and windows, one window section alternating with two 10-ft. doors. Louvers are provided in the space between the bottom of the windows and floor for ventilating purposes. With the rolling doors about 75 per cent of the lower part of the building may be opened insuring a free circulating of air during the hot weather. In the roof there are sixty 66-in. Swartwout ventilators. The floor consists of asphalt blocks laid on a concrete base and the building is covered with a cement slab roof.

The plant is equipped with ten hardening furnaces, eight of these being located in a row across one end. These are double-end furnaces, the work being charged into one end and removed from the other. Four Gleason quenching machines are provided for quenching ring gears. The carbonizing furnaces, twenty-four in number, are arranged in two rows lengthwise in the building back to back, (see Fig. 9). All the furnaces are oil fired. They were supplied by the American Shop Equipment Co.

Stationary quenching tanks are entirely eliminated and in their place portable tanks are used, these being pushed along a track in front of the furnaces. These tanks are about 60 in. long, 30 in. wide and the same height as the furnace hearths. There are pipe connections and valves beneath for connecting the tanks with the oil circulating system and the water pipes, the necessary lines being carried in a tunnel beneath the track. Water is discharged from the tanks to the sewer and oil is carried back to the oil-filtering tanks. Carbonizing pots are drawn from the furnace onto a portable unloading table of steel-frame and brick-floor construction that is moved about with a hand truck. This table is placed directly in front of the furnace door and parts are dumped from the pots onto the table and pushed from the table into the quenching tank. Work is cleaned on a Pangborn rotary sand blast machine.

The fuel, air, water and oil lines and pyrometer wiring are carried in a series of tunnels beneath the floor, leaving the overhead clear. The building has a 100 x 40-ft. sub-basement for blowers and storage and for entrance to the tunnels. There are seven 20,000-gal. tanks outside the building for oil storage. Central control of the furnaces is provided with two pyrometer rooms, one on each side of the plant and serving the furnaces on that side.

National Standard Truck Cost System Adopted

National Automobile Chamber of Commerce at the recent general meeting of motor truck members upon recommendation of the motor truck committee and the convention of service managers at Indianapolis, adopted the national standard truck cost system and recommended that truck manufacturers, dealers and users utilize it in computing truck operating costs.

As of July 25, France formally dropped the prohibition of automobile imports. The customs duties remain the same, 45 per cent.

New Aluminum Solder Successful

The difficulties encountered in attempting to solder aluminum are familiar to all who have experimented with the multitude of so-called aluminum solders which have appeared within the last few years. One of the chief sources of annoyance has been the tendency for electrolytic corrosion to set in at the joint, the aluminum being corroded, since the components of these solders are electronegative to aluminum. This difficulty has been successfully met and a new solder, the components of which are located so close to aluminum in the electro-chemical series that electrolytic action is rendered negligible, has been placed on the market by the Rohde Laboratory Supply Co. of New York City.

This material—which is called "Al-Solder"—is applied at a temperature of about 500 to 600 deg. F, so that warping and other mechanical disturbances are avoided. After a moment's heating, an exothermic reaction takes places with the formation of an alloy. Since an alloy is formed with the aluminum, the durability of the joints is permanent and the seams can be made invisible by polishing, which is very desirable in instrument work, etc. Furthermore the joint may be reheated without injury so that an additional piece may be joined on without any trouble.

Millions to Be Spent on Canadian Highways

Five million dollars will be spent this year in making better the main highways of Canada through Federal and provincial grants. Of this amount the Dominion government will contribute $2,000,000 and the provincial governments $3,000,000. This is the first year in which road money has been available, and in view of the time taken in preparing plans the initial year's outlays will not be so heavy as in some succeeding years.

The improvement scheme however is general. Before the Dominion government makes any grant for the purpose the Provinces have to file general plans, and every one of them from coast to coast, has done so already. The detailed plans also need approval by the Dominion government, and this has been done in several instances and work is under way. While the Provinces may improve whatever roads they choose to, the Dominion grant of 40 per cent of the cost is restricted to main or trunk highways.

Western Canada Buying Many Tractors

The number of tractors sold in Western Canada during 1919 is reported in Canadian Farm Implements as follows:

8-16 to 10-20 h.p.	4791
11-22 to 12-24 h.p.	1487
14-28 to 16-32 h.p.	2011
17-34 to 20-40 h.p.	374
22-45 h.p. and over	181
Total gas tractors	8844
Steam tractors, all sizes	104
Total all tractors	8948

The motor truck committee of the National Automobile Chamber of Commerce has been increased from seven to nine members by the addition of Victor L. Brown (Sterling) and A. J. Whipple (Diamond T).

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THE AUTOMOTIVE MANUFACTURER, a consolidation of THE HUB, established in 1858, and AUTOMOTIVE ENGINEERING, established in 1916, is an authoritative journal, presenting everything entering into the construction of automotive vehicles which is new or worthy of consideration by automotive engineers and manufacturers.

Vol. LXII SEPTEMBER, 1920 No. 6

Need for Thought About Ratings

WITH the addition to the list of users of four-valve engines of one of the most prominent names, an unusual situation arises with regard to power ratings. The need for the rating as a rough basis of comparison of cars and trucks similar except as to motor, as a basis of taxation, as useful and necessary in registration offices, and otherwise, is admitted. When it comes to comparison of similar vehicles and taxation however it must be granted that the present rating formula is somewhat lacking.

It was originated and proven out before there were such things as multiple valves, that while the use of one inlet and one exhaust per cylinder was universal. Events of the past three or four years have proven that a greater number of valves, regardless of the exact number, will give greater power. If this were all that more valves gave the usual formula might still be as useful as ever for all admit that it is far from perfect. But the multiple-valved engine has quicker and better acceleration, greater pulling power at low speeds which gives hill-climbing ability, and other marked advantages, not the least of which under present conditions is greater economy of fuel.

All these things combine to make the engine quite markedly different, and above all, quite different from what the rating formula indicates it to be. The formula was never intended to include two-cycle engines, Diesel engines, semi-Diesel engines, or other engines which were quite apparently different. We submit that, in this sense, the four-valve motor or for that matter any multiple valve motor, is also different. From this point of view, desirable as the present universal use of the rating formula is, a new and different formula should be evolved for the multiple valve forms.

This will not be easy and should not be done in a hurry. Moreover when done it should take into account more modern construction, for materials, design and workmanship have materially improved since the original formula was worked out more than twelve years ago.

Ford Does It Again

HENRY FORD has been the leader of the automotive industry in so many ways and at so many different times that it is not, on the whole, surprising to find him showing the industry the proper way again. This he has done in his latest announcement reducing all Ford cars, trucks and tractors in price by a substantial amount. The recent slump in the sale of autotmobiles should have taught the industry the lesson that the peak had been passed, that the people wanted and would have lower prices, and that it was highly important to have these right away so as to obtain the maximum amount of fall and winter business before the close of the year and to insure disposing of all of this year's output before starting in on next year's. It remained for Ford to see all this clearly, despite unfilled orders on hand for immediate delivery amounting to almost 150,000 cars, trucks and tractors, and his latest action shows that he saw it clearly and acted at once.

Now it remains to be seen whether this lesson will have its influence on the industry, and whether it will be followed promptly by similar cuts by the other makers. It would almost seem as though the makers of small cars would be forced to follow suit at once, although the makers of larger and more expensive cars, which are selling better than small cars because of the superior financing ability of their prospective purchasers, may be able to postpone action until later in the year. At the latter time, the results of Ford's action, and of similar action by other manufacturers, if any, will be visible in lowered price of materials, and the other makers will be in a position to announce the reduced prices as applied to their 1921 models. The presumption is that the situation will work out in that way, a few smallcar makers following Ford's lead, but the larger number carrying the reduction forward to next year's models.

Only Work and Faith Needed

UNDER present conditions, which it must be admitted are not satisfactory to anyone, worker, idler, consumer, retailer, wholesaler, manufacturer, laborer or banker, pessimists are often heard to declare that this country is on the verge of a panic, going to destruction, or something along the same lines and equally ridiculous. The cold hard facts prove that this is impossible.

John Fletcher, vice president of the Fort Dearborn bank, recently handed a few figures on panics to Chicago's big business men at the meeting of the Association of Commerce: "There are people foolish enough to talk about the possibilities of panic. With but 5 per cent of the earth's population we have 24 per cent of its agricultural production, 40 per cent of the mineral production, and we manufacture 35 per cent of its goods. Our natural wealth is above $225,000,000,000 while that of our nearest competitor, England, is but $80,000,000,000. With this it is impossible for things to go wrong. The real trouble in this country today is that there is a premium on idleness. Our trade balance today is $5,000,000,000. We have repurchased our foreign placed securities to the value of about $8,000,000,000. We have loaned our allies $9,000,000,000 or $10,000,000,000. Half of the gold in the world is in the United States, and the deposits in the banks of this country are billions more than the total in all the other banks of the world."

Relation of Motor Trucks to Petroleum Distribution

By A. F. BEAN*

UNTIL very recently—within the last three years, the rolling or distributing equipment, that is, the tank trucks used by oil companies, have received comparatively little thought and less care.

The result has been that the cost per gallon for delivery to the customer or the filling station has been considerably higher than necessary. There are certain fundamental and basic principles which must be carefully observed or this department of the industry must be an inevitable failure.

The major portion of the blame for this condition rests with the oil companies, although some of it is chargeable to truck salesmen and to truck tank builders. This has not been malicious or intentional but is the result of ignorance and a lack of study of operating conditions.

In this connection we feel obliged to quote a portion of two very pertinent paragraphs from an article entitled, "Study Haulage" and recently appearing in one of the motor magazines. The first is: "A truck dealer should sell motor transportation and a truck salesman should be a transportation engineer." The second: "Don't go into a prospect's office until you know his transportation problems."

It is quite evident that there is something radically wrong when one company shows a delivery cost in a certain city ranging from two to two and a half cents a gallon while another company operating under almost identical conditions and opportunities in the same city shows a cost ranging from four-tenths to seven-tenths cents per gallon.

The manager who has carefully analyzed the various factors entering into the cost of delivery is the one who is delivering at a cent or less per gallon. A number of managers believe they are delivering below the one cent mark because their bookkeeping departments are not given sufficient data and are not taking into account all of the items.

There are a large number of the smaller independent oil companies who haven't the faintest idea of what their delivery cost is; furthermore they are not taking any steps to find out and the writer has talked to some managers who haven't even an idea how to inaugurate a system that will give them the desired information or what items should be taken into account in order to determine what their trucking costs really are. This is not an exaggerated statement.

A hight cost of delivery may be due to any one of a number of causes or to a combination of a number of them. Among these are: the wrong use of an improperly designed truck or tank; the use of trucks of a wrong capacity on a certain route; too great a mileage for the gallons delivered improper routing; excessively high maintenance charges due to overload; undertired vehicles, or poor inspection and repair methods and to high operating costs or from carrying an underload. There is also a great deal chargeable against careless, untrained and generally indifferent chauffeurs.

Let us consider how some of these items affect the final costs.

*Consulting Engineer, Wayne Oil Tank and Pump Co.

Every possible item of expense connected with the truck must be taken into account when calculating the cost of delivery per gallon. It necessarily follows that if we can design, operate and maintain our trucks, so that we have reduced the cost of delivery per gallon a fraction of a cent, we have added that same amount to the profits on every gallon we sell. It is necessary before we can make efficient any system for either maintenance or operation that we have the proper trucks.

The first thing necessary is to determine on a specification that will give us the truck with the lowest operating and maintenance charge in this particular line of work.

Experience has already taught practically all truck operators two very important lessons.

The first is that the truck that is cheap in price at the time of purchase rarely develops to be a cheap truck from an operating viewpoint over a period of years.

The second is that in operating a fleet of trucks in either one of a number of cities it is very costly to experiment with several makes of trucks. Using only one make of truck very materially reduces the cost of repairs, and simplifies all the problems of service, the stocking of repair parts, etc. It also has another important feature and that is that a great many truck operators fail to realize that both passenger cars and trucks are a little bit human in their actions and each make has certain peculiarities. The use of only one make of truck will greatly assist the truck manager, repairmen and drivers to learn these mechanical peculiarities and thus come more nearly to 100 per cent operating efficiency.

The standardization of equipment will help in the solving of the various loading and operating problems; will cut repair shop and repair part stock room space and cost; will cut fuel consumption; will make easier the planning of garages, repair and paint shop, loading racks, etc.; will reduce the labor required at large distributing plants and simplify the accounting system. It will also allow the interchange of bodies on units of like capacity and make and design of these bodies a much easier problem.

There are a few things in connection with motor trucks as related to the distribution of petroleum products with which we wish to thoroughly impregnate the oil man's mind, for this reason we have already made and will continue to make several repetitions of the subject matter in slightly different language.

The first thing is the choice of the truck. The oil company has a choice of many good trucks. None of them are wholly bad. Pick a make of truck that will conform to your specification and embodies the best material and workmanship. This usually means a truck well above the average in cost. See that the manaufacturer is one of good financial standing so that your trucks are not in a position to become orphans at the end of two or three years and leave you high and dry for repair parts, or with long waits and excessive charges.

They should have a reasonable number of well stocked service stations in every locality where your trucks will be operated.

Keep away from trucks assembled from mongrel parts.

(Concluded on page 26)

New Electric Spring-Treating Furnaces Increase Production

Details of New Ovens, Heated and Controlled Electrically, as Used by Large Bridgeport Spring Company

PRODUCTION is the demand of the day, and the pressure of this demand on automotive vehicle manufacturers extends backwards through all the ramifications of the industry, back through all its supplying manufacturers of parts, units and accessories, as well as further back to the producers and refiners of raw materials. At first sight one would say there was little in common between complete vehicle manufacturers and spring manufacturers, yet there is a very close connection. Large demands for the former produce automatically large demands on the latter. So it happens that right now all the good spring manufacturers are very busy. And most of them are seeking ways and means of increasing their output, that is, methods of producing greater output of equal quality. The following is a description of the new equipment and methods used by one prominent spring maker to achieve this very desirable result.

Few automobile users realize to what an extent the heat treatment of the springs influences both their safety and comfort while riding, as well as the life of the car. This applies equally to heavy motor trucks and passenger cars, and for essentially the same reasons. With poorly heat treated springs necessitating a low rate of action, the engine and body of the car are subjected to a continuous succession of shocks, which cause cumulative mechanical strains that cannot do otherwise than render it a more or less permanent inhabitant of the repair shop.

If, through improper heating treatment the spring breaks, the result and inconvenience need not be described, it is sufficiently familiar to most people.

Possibly the reason why this question of spring reliability has not been more prominent is because the manufacturers of the springs have taken such care in heat treating that failure of springs are the exception. People are very apt to take a thing for granted when it never calls attention to itself by failure to function properly. This principle of giving the greatest care to the processes used in properly tempering springs and the most up to date methods of heat treating and drawing, are exemplified in the plant of the Spring Perch Co. of Bridgeport, Conn., makers of various types of high grade automobile and vehicle springs.

One of the processes used by this firm presents an interesting example of the application of electric heat to this form of industry. When the springs have been hardened, they are exceedingly brittle, and it is necessary to give them a heat treatment called tempering to reduce this brittleness, and still retain the temper. In doing this it is highly important that all springs receive the same amount of heat penetration in order that the product be uniform.

For this purpose they have installed two electrically heated furnaces, which are round in form and about twelve feet in diameter, the hearth consisting of a revolving steel table, about 10 ft. 8 in. in diameter. These tables are driven by an electric motor, and the speed can be varied from one revolution per hour, to one in 20 minutes, according to the class of work to be done. The springs are put on this table through a door in the side, and taken out of the same door when finished. With this arrangement

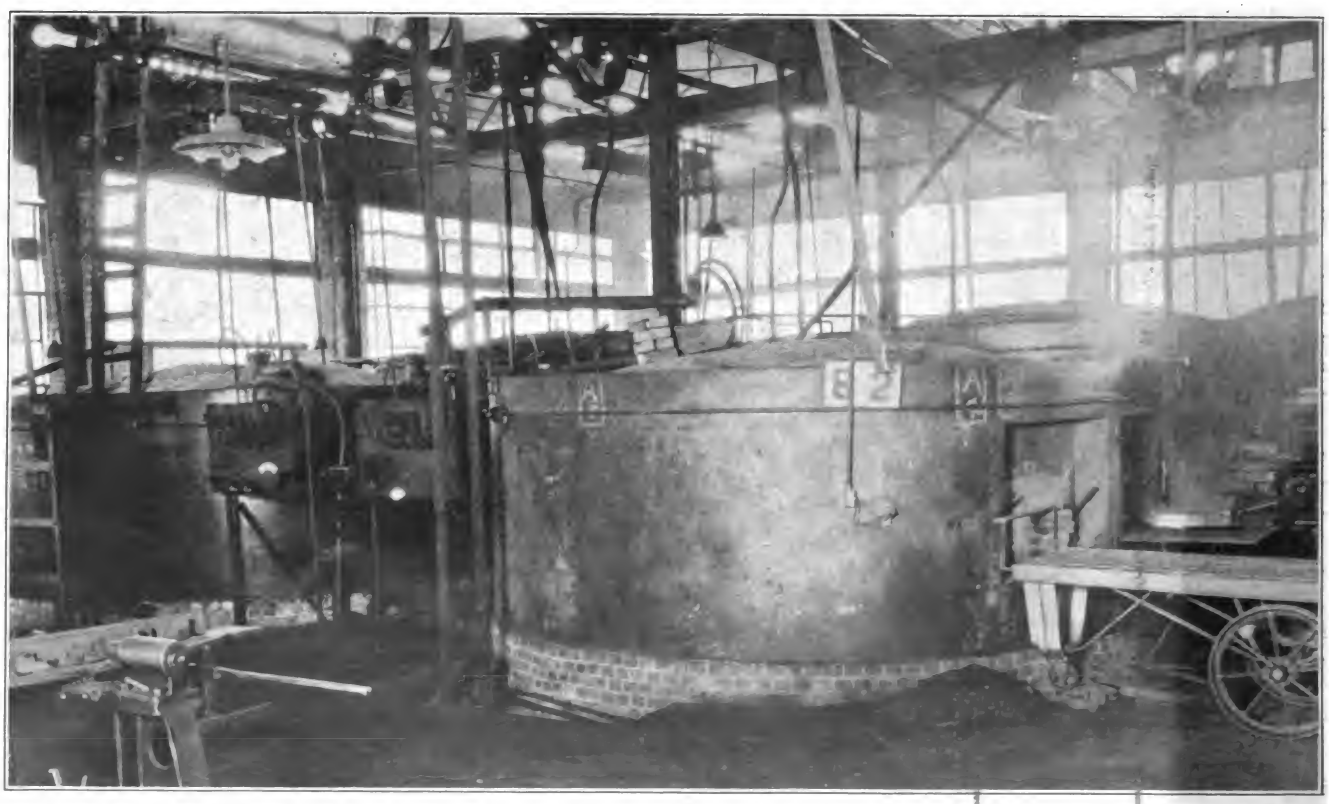

Fig. 1. General view of the electrically heated, electrically controlled ovens in the Bridgeport plant of the Spring Perch Co.

Fig. 2. Detail of the Rotary type oven in actual operation, showing how the workman feeds the springs into the opening

the production is about 2,000 lbs. per hour for each furnace, or in a 16 hour day the two furnaces turn out about 64,000 lbs.

The electric heating units are installed in the roof of the furnace, about 10 in. above the table. They are of the General Electric Co. 950 o F type of heating unit, and form a connected load of 85 k.w. for each furnace. The roof of the furnace is arched, so as to reflect the heat, and give an absolutely even distribution of heat throughout the interior of the furnace. All hot spots which would cause some springs to be heated more than others, or otherwise destroy the uniformity of the product are eliminated by this method of construction.

The control, which is entirely automatic, was also supplied by the General Electric Co., and consists of a contactor panel for each furnace, controlled by a temperature regulator, which is installed in a booth at some distance from the furnace. All that is necessary to obtain any temperature desired between 800 and 1,000 deg. F. is to set the regulator and close the switch for that furnace. Owing to the automatic control the furnace will run itself, and keep absolutely to the exact degree of heat required. Since it is desireable to vary the degree of heat, in accordance with the varying composition of the springs to be heated, the value of an absolutely reliable and flexible temperature control is self-evident.

These features of accurate temperature control, and evenness of heat distribution for any temperature in a word the factors that guarantee the uniformity of the finished product, are more or less confined to the electric furnace. The Spring Perch Co. subject all their products to a Brinell test to determine their perfection before shipping, and claim as a result of the process that they are absolutely uniform.

Fig. 3. Recording and indicating automatic control instruments for rotary spring ovens at the Spring Perch plant

New Gasoline Substitute an Alcohol Derivative

Low Price and Great Economy Claimed from Fermogas, Made from Alcohol by Special Process—Opportunity for Brewing Plants Now Idle

As is usually the case with new things, and particularly new things for which very much are claimed, much skepticism surrounds the production of each new motor car fuel. This is primarily because in every previous instance, the public has found out by costly trial that there was nothing in it, that the new fuel would not do what its inventor claimed. Whether this will be true also of Fermogas, now announced as a cheaper fuel, which can be made readily by any brewing plant, remains to be seen.

At any rate, the Fermogas Corp., New York, N. Y., is selling stock par value $10 a share, the tangible assets of the company being a secret formula and a special process, through the use of both of which Fermogas can be made for 5 cents a gallon, to sell at 17 cents. Obviously, this offers a large margin of profit, aside from being a great boon to motorists.

Demonstrations, which have been going on both in the Industrial Research Laboratory in Brooklyn, where the Fermogas Corp. has its headquarters, and at an automobile salesroom on Broadway, prove that Fermogas is an active and apparently successful fuel. In a general way it may be described as a specially denatured alcohol wherein the denaturizing agent is a petroleum or coal tar derivative whose presence not only renders unpalatable the alcohol, which in accordance with the Eighteenth Amendment to the U. S. Constitution, is a poison, but also modifies and vastly improves its qualities as fuel for internal combustion engines.

The manufacture of Fermogas interestingly involves two distinctive features, the first of which is "Mucorbacty," while the second is the P. J. Chasler process of distillation. Both are controlled by the Fermogas Corp., capital $1,000,000, which proposes to produce "Mucorbacty" for the brewers and others, whom it is hoped to enlist in the manufacture of Fermogas, and which will also license them to use the Chasler process.

From the standpoint of the brewers, to whom the enterprise is being introduced, the proposition is attractive, not merely by reason of the ratio of five to seventeen, representing the assumed relation of cost to profit, but rather more the use it offers immediate occupation for their now idle plants. These, it is said, can be readily converted to the manufacture of alcohol by the addition of only comparatively small items of new equipment.

Automobile manufacturers, to whom circulars have also been addressed, find the subject of interest, not only because a substitute is offered at half the present price of gasoline or thereabouts, but because Fermogas is offered as a better, as well as a cheaper fuel. The interest of the public seems to be assured, in turn, not merely by reason of the attraction of low price, but because of the greater mileage which Fermogas will yield as compared with gasoline. This, it is said, may amount to an increase of as much as 75 per cent.

Perusal of the second circular, which has been sent to automobile manufacturers who were sufficiently interested in the first to reply to it, yields many details from which, and from interviews with various representatives of the Fermogas Corp., the general information that immediately follows has been derived. This is offered with the understanding that the subject is an intricate one, involving the abstruse field of organic chemistry, the labyrinths of which the layman often has difficulty in penetrating.

"Mucorbacty," it is understood, is an agent of fermentation, or yeast, prepared by a special and somewhat secret process, and which possesses the peculiar advantage that it yields 24.9 times as much alcohol as any similar agent known. It is this yeast which the Fermogas Corp. proposes to produce, and which it will supply to the brewers and others who will make Fermogas under license. It is said that it can be made to sell at 10 cents a pound, while 40 cents' worth, or four pounds, will be sufficient to ferment one ton of mash.

Cellulose or starchy materials of almost any kind may be used for fermentation purposes, included in the long list mentioned being corn stalks, sugar cane, sorghum, cabbage, beets, potatoes and so on through the vegetable kingdom. A logical, but possibly not obvious sidelight on the possibilities involved is afforded by the suggestion that "its manufacture yields besides 109 gallons of the alcohol a byproduct, viz., a very rich fertilizer, in amounts of 500-550 pounds per ton of substrate used."

"Mucorbacty" itself is produced by the mouldering of bread, which is kept warm, moist and fresh as the process goes on. For the nutriment of the bacterium thus cultivated a "bacterial medium" is prepared, consisting of a certain amount of ordinary compressed yeast, pasteurized milk and fresh blood, "preferably that of a well developed horse," the second circular says, though it adds, "but the blood of any of the larger mammals, preferably the male, is utilizable." The bread mold is added to this mixture, some fresh bread being fed to the fast growing bacteria at the same time, and the resulting mass is then mixed, kneaded into a dough with the addition of water at a suitable temperature, raised for six to ten hours and then rekneaded, rolled into layers and placed on frames to dry. It is afterwards pulverized, packed and shipped to the brewers.

The P. J. Chasler process, which it is expected the brewers will soon be using, involves a special method of distillation, whereby the alcohol vapor, coming over from the mash, is allowed to bubble up through a bath containing tar or oil. The contents of the vat being heated, give off certain volatile constituents, which combine with the alcohol to form the resulting fuel compound. As excessive quantities of the heavier oils pass over into the condenser in globular form, it is necessary to run the Fermogas through a centrifugal separator before delivering it to the consumer, in order to remove the globules, which otherwise might stick in the throat of the venturi in the carburetor.

Already the Fermogas Corp. has in operation in Brooklyn a demonstration plant and laboratory, as well as an active publicity and mailing department. Through the latter great quantities of literature are being sent out, not

(Concluded on page 26)

Australian Timber Trade Possibilities

Reasons Why Australia, and Particularly New South Wales, Can Not be Considered as Large Possible Sources of Timber—Large Imports

NEVER has there been such a demand for lumber and timber, in fact wood of all kinds the world over, as at present. Wood is in demand for building low priced houses, for coach and carriage body work, for furniture and other furnishings, as pulp wood for paper, as handles or other parts of implements, and for many other uses. The timber of the United States has admittedly been depleted to a marked extent, with little or no reforestation to provide a future supply. Under these circumstances of great excess demand and dwindling supplies, it is important to look around at other countries of the world to see where additional present and future supplies are to be found.

Australia has long been looked upon as such a source of wood, but actual facts show that prices there have gone up, as for instance Douglas fir in 1914 sold for $29 per m; in Sept., 1919, it had advanaced to $116. Similarly, California redwood which was $51 advanced to $145, Baltic dressed timber went from $40 to $120, New Zealand white pine from $35 to $100, and other kinds in proportion

Judging from these facts, Australia and especially New South Wales, to which all of the following refers, does not present quite the promising field it was thought to. There Douglas fir has never been generally used for the same purpose as Baltic dressed timber, and the New South Wales market has not, within recent years, imported any other than dressed timber from the Baltic. Baltic timber is used for floorings, linings and weatherboards. Douglas fir is used for larger construction work, in carpentry, and for studding, rafters of cottages, and the like. It is also used where long timbers are needed, and to a limited extent in joinery. California redwood is used especially for joinery, interior fittings, cover molds and moldings, and is now being used to a limited extent for weatherboards.

Baltic timbers were formerly considered by timber merchants to be the most remuneratitve line. The timber arrived in excellent condition, had a good hold on the market, and was merely stocked and retailed without working of any kind and with minimum labor and expenses. Labor is a troublesome factor in Australia. The New South Wales market for years past has not imported any Baltic other than dressed Baltic in flooring, lining and weatherboard sizes, all dressed and finished ready for use. Baltic timber is either red or white. The white is a spruce (Picea excelsa) and the red is a fir, the Scotch fir (Pinus silvestris). New South Wales bought practically only white Baltic. This timber, though knotty, has a very clean, white appearance, is well seasoned, and wears exceptionally well. For reasons above stated it would not compete to any degree with American timbers. The New Zealand timbers, rimu and white pine, are likely to compete more with the Baltic timbers than the American timbers. They are being used more for the same class of work.

Prior to the war Norway and Sweden had specialized in afforestation and timber production very efficiently, and a very high standard of production in quantity, finish and quality was attained. Norway and Sweden were then the principal countries exporting to Australia. Very little was imported from Russia or Finland. Both Norwegian and Swedish open water ports were efficiently served by excellent steamship services, which it is said, were subsidized by their respective governments. The principal factors in the rise in price of Baltic timber were the temporary elimination of Russia from the markets, the heavy demand from the usual centers of consumption, and the rise in the cost of living in Norway and Sweden. The mills in Norway and Sweden do not have any understanding among themselves regarding prices, but the best brands are regularly quoted about the same prices.

American Timbers

The Australian business in both Douglas fir and California redwood is in the hands of export houses, which in many cases own their own sailer tonnage. Generally speaking, this business was done by steamer prior to the war, but since the war shipments by sailing vessels have been the invariable rule.

The reason given for the increase in prices by producers in America since the war is chiefly the increased cost of production; but just before the war prices of both Douglas fir and California redwood had reached a very low level, and in any case, it would seem that some rise in price would have been justified apart from rising costs of production. Both in fir and redwood the market has for some four years past been largely a seller's rather than a buyer's market. These conditions are likely to continue for some little time to come, at least.

New South Wales Timbers—Ample Supplies of Hardwood—Uses

It is in local hardwoods that the keenest competitor of Douglas fir is found. For small construction work hardwood is excellent, and the demand during and since the war has grown enormously and prices have considerably increased. New South Wales hardwoods are altogether exceptional timbers. It is a fact that this State has never been able to conserve its great timber resources as they are worthy of being conserved. The hardwood supplies for the New South Wales market are chiefly in the hands of one firm. There is no immediate prospect of a scarcity in hardwood supplies, but timber cutting and timber freighting in New South Wales were difficult problems even before the war, owing to the scattered population and the inaccessibility and comparatively sparseness of the timber. Hardwood is competing more and more with American timbers as these rise in price. Supplies of hardwood weatherboards make it impossible for us to import Baltic weatherboards at present, and similarly hardwood is now being used in much of the cottage building, whereas Douglas fir was formerly regularly used. Hardwood can not be used for joinery and is a much more difficult wood to use in carpentry. It is also much more costly to handle because of its weight, but the higher price of Douglas fir is bringing the hardwood more and more into use.

Supplies of Australian timbers are somewhat erratic, and the time is rapidly approaching when supplies will be

exhausted. Just before the war some business was done in Queensland in fir, but the supply of local timbers there makes it impossible now to import American timbers. However this position will probably be reversed when American timbers become cheaper and the supplies of local timber become scarcer.

In Victoria the competition of the local timbers is even keener than here, and South Australia is drawing more from Tasmania and western Australia than ever before, but still must continue to import large quantities of Oregon fir and California redwood.

Prior to the war good business was done throughout Australia in case timber from the Baltic—that is, timber cut to size for making boxes.

It is interesting in this connection to note the fall of imports, exports and production in recent years. Total exports for all of Australia were 444,035,000 ft. in 1912, rising slightly in 1913, and since falling steadily, to 169,-981,000 ft. in 1917, less than one-third of the former totals. in the former year, exports amounted to 121,252,000 ft. and 136,177,000 ft. the following year but thereafter decreased steadily to 35,829,000 ft. in 1916, barely one-fourth of the high mark. Production of sawn and hewn timber amounted to 684,890,000 ft. which was the biggest output. Since then it has dwindled steadily and in 1917 was but 444,955,000 ft. The latter figure of total production scarcely tops the country's imports in 1912 and is less than those of 1913, so it is not safe to think of Australia as a potential timber market.

Relation of Trucks to Oil Distribution

(Continued from page 21)

The capacity of the trucks to be used will depend entirely upon the territory to be served and the business to be handled.

The sizes which are giving the best average results range from one and a half to three and a half tons.

The three-quarter ton and one ton trucks very seldom earn their way at small stations but have been used to good advantage in making emergency deliveries, when attached to a large fleet of trucks in the larger cities.

The trucks of from four to seven and a half tons capacity have given very good results in large dump load service on good roads and where the routes were of comparatively short mileage.

One thing to be remembered is that on routes where the gallonage will warrant, it is cheaper to operate a five ton truck than two trucks of one-half that capacity.

Some municipalities have already limited and others are considering limiting the capacity of trucks which shall be allowed on the public streets and highways.

Because of the cost of construction and maintenance of highways and streets it is more than probable that trucks of more than five tons capacity will not be allowed in a great many localities.

There is a question among many highway and municipal engineers as to whether the limit of the load allowed on a highway should be based upon the pay load capacity of the vehicle or upon its upsprung weight.

Anticipate your needs in the truck line, well in advance. Do not wait until a few days or even weeks before the time you wish to put the finished trucks into service and then expect to get what you want in either chassis or body or expect to get the truck which will give you the best service.

When this course is followed, the result is usually that some truck other than the right one is purchased and the cost paid in after years.

Lack of space prevents giving the specifications for motor truck chassis, suitable for use in the distribution of petroleum products, including recommended tire sizes, speeds and other desirable information, as given in detail by Mr. Bean.

New Gasoline Substitute from Alcohol

(Continued from page 24)

only all over the United States, but to foreign countries as well, the circulars being neatly gotten up in several languages. Although the corporation has offices in New York the principals in the enterprise spend a good deal of their time at the laboratory, conducting visitors about and demonstrating the properties of Fermogas, which are much like those of "benzol spirits," which is well known in Europe, and was extensively used by the Germans during the war.

Of those associated in the enterprise Chasler himself is described as a former civilian employee of the United States Government, injured in the service and now retired on a pension of $1,600 a month. It is the pecuniary independence of the inventor, thus explained, which is brought to notice as the reason why the venture is not in need of money, in the sense common to so many similar ventures.

Along with the introductory process it is planned to stage convincing demonstrations calculated to satisfy any questions concerning the nature of the fuel that may arise, and in that connection at least one well known consulting engineer in the automobile line has been approached with a view to conducting laboratory tests. Arrangements pending with brewers now in involuntary retirement will, it is said, soon permit Fermogas to be placed on sale at the curb.

According to one of the stockholders in the corporation not less than 250,000 gallons daily capacity, from four breweries will be available soon. At a cost of 5 cents the gallon, this would involve a turnover for the four breweries of at least $12,500 a day. Further, to show the magnitude of the pending enterprise, it is calculated from the second circular that 12,500 tons of mash would be fermented and distilled every day. The difficulty of understanding how it is possible to gather, ship in, store, dessicate, dissolve, ferment, distil and handle even waste material involving a daily turnover of 12,500 tons at a dollar a ton, is of course explained by the fact that the mash is, in large percentage, composed of water, which naturally costs nothing at all.

The Peking Motor Club has been formed in Peking, China, and is furthering plans for completing the missing links in the Peking-Tientsin road. When these gaps are closed this road will have a length available for automobile travel of about 80 miles. The section from Peking to Tungchow, 13 miles long, was completed in 1917.

British South Africa took 2,596 American motor cars in 1917, 2,099 Canadian, and 36 British. In 1918, the figures were 1,203,456 and 4. Of the 30 trucks in 1917 and 16 in 1918, the United States furnished all but one.

Manufacturers Study Better Boxing and Crating

Fourth Commercial Instruction Course Ends Successfully at Forest Products Laboratory

WITH an enrollment of eleven officials of box factories and box using concerns, the fourth commercial course in boxing and crating at the Forest Products Laboratory ended Saturday, Aug. 14. The object of the course was to demonstrate for manufacturers and shippers the principles that underlie proper box and crate construction and the development of economical containers that will deliver their contents to their destination in a satisfactory condition at a minimum cost.

The men who attended the course came from many widely differing industries, including box and packing concerns, brass manufacturers, bearing companies, express companies and others.

Courses Are Twofold in Purpose

The course of instruction is so arranged as to accomplish as far as possible in the short space of a week a twofold purpose: to acquaint the representatives of the commercial firms with the methods and ideas evolved by the laboratory men, and to permit those attending the school to exchange ideas and experiences. The program of the course follows:

I. Monday, 8 to 12:15. Registration and tour of inspection of Forest Products Laboratory.

Monday, 1:15 to 4:00. Tests on various types of box construction to show characteristic failures. Drop test used.

II. Tuesday, 8:00 to 12:15. Demonstrations to show the necessity of adequate nailing and that serviceable boxes can not be obtained by using thick lumber when not adequately nailed. Small drum machine used.

III. Tuesday, 1:15 to 4:00. Demonstration to show effect of using one, two and three pieces in ends, sides, top and bottom. Compression tests used.

IV. Wednesday, 8:00 to 12:15. Demonstration to show the relative holding power of different kinds of nails, sizes of nails of same kind, and different species of wood. Tension testing machine used.

V. Wednesday, 1:15 to 4:00. Demonstration showing the weakening effect of using wet lumber for boxes especially with reference to nailing and strapping. Small drum tests. Informal 6 o'clock dinner at Capitol Cafe attended by class and laboratory staff.

VI. Thursday, 8:00 to 12:15. Demonstration showing the advantage of using dense wood in box construction. Large drum tests.

VII. Thursday, 1:15 to 4:00. Strapping. Methods of application and efficiency. See I and II.

VIII. Friday, 8:00 to 12:15. Tests and discussion on solid and corrugated fiber board boxes, wire bound boxes and crates.

IX. Friday, 1:15 to 4:00. Identification of woods.

X. Friday, 7:30 p. m. Informal smoker at the University Club for those attending the course and members of the laboratory staff.

XI. Saturday, 8:00 to 12:00. Talk on characteristics, distribution and availability of various box species. Resume and general discussion. Conference between individuals and members of the staff.

Shipping Damages Demonstrate Packing Needs

The importance of using better containers and establishing more efficient packing methods is demonstrated by the fact that during the year 1919 Class 1, railroads expended for lost and damaged freight the sum of $103,078,862. The western inspection bureau in twelve cities during one month refused or repaired 43,738 packages. This loss has become so great that the retail merchants are beginning to demand of the manufacturer that his merchandise be shipped in strong packing cases bound with iron or steel. And foreign dealers are intimating that unless stronger boxes, barrels and crates are used, a considerable part of the American export trade will be lost, due to the fact that foreign buyers and carriers decline to pay claims for loss and damage on American goods.

Commercial research on better containers was begun by the Forest Products Laboratory in 1915 in cooperation with the National Association of Box Manufacturers and the National Canners' and the National Wholesale Grocers' Associations. In this work were developed methods and testing equipment which have become standard.

The laboratory has cooperated with associations and companies in improving the packing of widely varying types of commodities such as electric lamps, cream separators, small tractors, talking machines, boiler castings, furniture, paints and oils, piano benches, fruit baskets and crates and shoes. These tests and studies, in many cases, resulted in the redesign of the container. The new design gave increased strength and often decreased the amount of material used in its manufacture; gave security against pilfering; decreased the cubic contents, thus reducing shipping space and the cost of ocean freight; reduced the labor and cost of manufacture; developed more rapid production of packages; and permitted improved methods of handling freight. This work is of value to all manufacturers, shippers and dealers, and the public at large, which is vitally concerned in receiving its necessary commodities in satisfactory and economical containers.

Courses Will Be Repeated Monthly

The Boxing and Crating course at the Forest Products Laboratory will be repeated monthly as long as there is a demand for it. The course lasts five and one-half days. Reference material and condensed notes are given out and it is necessary for those attending to devote a portion of each evening to study. Heretofore only twelve men have been accepted in a class, but on account of the popularity of the courses it is the intention to increase this limit to sixteen. The limited enrollment makes possible the exchange of ideas and experience between men from different organizations and the research men of the laboratory. To help meet the cost of the course a cooperative fee of $75 a man is charged.

Application for enrollment in the courses have been received for several months in advance. Courses begin on the following dates:

September 13, 1920	January 10, 1921
October 4, 1920	February 7, 1921
November 8, 1920	March 7, 1921
December 6, 1920	April 4, 1921

Acute Lumber Shortage Handicaps Industries

Present Rate of Use Indicates Complete Exhaustion in Less Than 40 Years Unless Widespread Reforestation Is Adopted—Vehicle Industry's Needs

IN recent years we have heard a great deal about the shortage of this kind of timber or that kind of wood. most recently we have heard a great deal about the shortage of pulp wood suitable for making paper. All of this however has not served to impress sufficiently upon the public consciousness the real fact which is that more than two-thirds of the country's timber area has been cut over, culled or burned, so that it has ceased to be timber area as such. Further, what remains will last much less than 40 years, at which time we will have complete exhaustion, unless extensive reforestation is adopted and put into practice very quickly and followed up vigorously.

The original forests of the United States are estimated to have covered 822,000,000 acres and to have contained 5,200 billion board feet of timber. Of this there are left today about 137,000,000 acres of virgin timber, 112,000,000 acres of culled and second-growth timber large enough for sawing, 133,000,000 acres partially stocked with smaller growth, and 81,000,000 acres of devastated and practically waste land. This totals 463,000,000 acres of forest land of all sorts which contains about 2,214 billion feet of timber of merchantable sizes. Against this the cutting and loss of merchantable timber consume about 56 billion board feet yearly. About 40 billion feet of this amount is cut from the virgin forests still left, the remaining 16 billion feet from second-growth. We are even cutting into pulp wood, acid wood and fuel 14 billion cubic feet per year of material too small for sawing. All told we are taking about 26 billion cubic feet of material out of our forests every year and growing about 6 billion cubic feet in them. We are even using trees too small for the saw mill but upon which our future lumber supply depends 3½ times as fast as they are being produced.

While simple division of the 56 billions used each year into the 2,214 billions said to be left would seem to indicate a supply for slightly more than 39 years, or for a round figure a little less than 40 years, this would not be a correct method of figuring. The government factor is the 40 billions which must be cut from virgin forests each year, that is the demands for large timber. Against this it will be remembered that there are 136,000,000 acres of virgin forest left. If this be considered as having slightly less timber per acre than our original virgin forests averaged, it will last at the current rate of consumption about 20 years.

This, it should be remembered, it too short a time in which to grow a new supply, and many varieties of the hardwoods in greatest demand can not be grown to cutting size in less than 45 or 50 years, and some others like black walnut require 60 to 70 years.

It would seem as though the foregoing puts the supply side of the situation with sufficient bluntness to be plain to everyone. In the matter of uses for various kinds of woods, and the effect which the present shortages, and the prospectively greater shortages, have had upon deliveries and prices, the situation is as bad or worse. Thus hardwood lumber prices during the past year have increased from 200 to 325 per cent and are still increasing. On practically no popular grade has the increase been less than 200 per cent. On quartered white oak, for example, mill prices have increased from $97 to more than $310 per thousand.

Location of the Great Hardwood Tracts

The original hardwood forests of the United States probably formed the most extensive, the most varied, and the most valuable temperate zone hardwood forest in the world. Outside of the tropics no other region supported such a large number of species of such high intrinsic value.

There have been four great hardwood centers in the United States—the Ohio Valley, the Lake States, the lower Mississippi Valley, and the Appalachian States. The Ohio Valley was once our main center of hardwood production. The lumber cut of Ohio, Illinois and Indiana alone as late as 1899 made up 25 per cent of our total hardwood cut. In 1906 it was only 14 per cent and in 1918 it had faalen to 8 per cent.

The three Lake States furnished less hardwood lumber in 1906 than in 1899, and less by nearly 30 per cent in 1918 than in 1906. A very considerable percentage of the hardwood lands in the Lake States is agricultural and is already or will eventually be used for crop production. Already the hardwood lumber cut from the Southern Appalachians—North Carolina, South Carolina, Virginia, West Virginia, Maryland, Kentucky, Tennessee, Alabama and Georgia—has fallen from approximately four billion feet in 1909 to 1.7 billion feet in 1918, or nearly 60 per cent from its maximum. The hardwood cut of the Appalachian States, which was approximately 40 per cent of that of the entire country in 1909, had fallen to less than 33 per cent in 1918.

The lower Mississippi Valley alone of all the hardwood regions appears to be holding its own in hardwood lumber production. The cut from Louisiana, Mississippi, Texas and Arkansas has varied only slightly during the past 10 years, and there is even the possibility of an increase over the existing cut of slightly less than 1½ billion board feet. West Virginia led all of the states in the production of hardwood lumber in 1917, but it is generally predicted that many of its saw mills will cut out their holdings in the next 10 or at the most 15 years.

As might be expected from a consideration of the principal hardwood regions, the total hardwood cut for the United States has been falling off since 1909. The reduction between 1909 and 1918 was approximately 40 per cent. Practically without exception the production of lumber from individual hardwood species has also been falling off. For the oaks production fell off from a little less than 4½ billion feet in 1919 to 2¼ billion feet in 1917; maple from 1,100,000,000 feet to 860,000,000,000 in the same period; yellow poplar from 1,115,000,000 feet in 1899 to 290,000,000 in 1918; ash from 291,000,000 in 1909 to 170,000,000,000 in 1918; hickory from 334,000,000 to less than 100,000,000 feet. The production of red gum is an exception to the general rule. The highest reported cut was in 1916.

The drain on the hardwood forests is by no means confined to the lumber cut. For ties, veneer, poles, handle and spoke stock, pulp wood, cooperage, etc., and exclusive of fuel the cut is probably 25 per cent greater than for lumber, totaling in the neighborhood of 5 billion board feet. To this must also be added an enormous volume cut for fuel, and still more destroyed by fire and disease, such as the chestnut blight.

It is not generally recognized how dependent a large number of our important industries are on hardwood timber. Many of the hardwood species have distinctive properties which fit them especially for the purposes for which they are being used. Substitution is usually difficult and unsatisfactory.

Vehicle Industry a Heavy Consumer

The vehicle industry is an example of an important industry dependent largely upon hardwoods. It requires annually in the neighborhood of 740 million board feet of lumber, of which 95 per cent is hardwoods.

The furniture industry requires annually in the neighborhood of 1¼ billion feet of lumber. In excess of 95 per cent of its requirements are for hardwoods and less than 5 per cent for soft woods.

The growth of the automobile industry has been so rapid and changes in requirements have been so frequent and radical that little data are available on its requirements as to amounts. The species most in demand are those which are also greatly in demand by other industries. The veneer industry used almost half a billion feet of material in the form of logs and flitches in 1911, and it is believed that requirements have greatly increased since that time.

The railroads of the United States are one of the largest lumber consumers with a normal demand of possibly 4 billion feet each year. The normal demand for railroad ties is in the neighborhood of 1½ billion feet each year.

One of the most disquieting features of the whole situation is that present requirements for lumber and the higher grade products are being supplied in large part from old-growth timber. Unfortunately, the small-sized second-growth hardwood timber is satisfactory for only a comparatively few of the uses, which are exacting in their requirements. Estimates have been made at various times by various agencies of parts of the hardwood area in the United States. It is not known however what the remaining stand of old-growth hardwood is at present. There is comparatively little knowledge of the quantity of materials which will reach merchantable size in the near future, that is there is no estimate of the board feet of each kind which will reach maturity each year. For the country as a whole there is every reason to believe timber supplies are being cut off three times more rapidly that the current growth (the U. S. Dept. of Agriculture, Forest Service says 3½ times), and for the hardwood forests the rate unquestionably exceeds this. There are no large reserve supplies, and in every principal hardwood region but one there has been an alarming decrease in the rate of lumber production and presumably also in the production of many other products. The importance of this statement, in comparison with the known demand for the harder woods, lies in the greater length of time required to grow them, the harder the wood the more slowly it grows, and by inversion, the greater the number of years it must be planted in advance of the actual use of the wood.

1920 Electrical Show Has Record List of Exhibits

The Electrical Exposition of 1920, the thirteenth annual display and demonstration of invention and development in the electrical field, will open in Grand Central Palace, New York, on Oct. 6, and continue for ten days. A record variety of exhibits has been arranged for, representing a forty-eight per cent increase over the 1919 show, and three floors of the big Palace will be filled with displays and demonstrations of a thousand and one uses of electricity The number of exhibits will be 141, representing as many individual manufacturers.

The purpose of the exposition is to show the varied employment of electricty in the home, office, store and factory.

This year the entire third floor of the Palace has been given over to a series of working exhibits where the employment of electricity in a score of industries will be demonstrated. One will be material handling, with industrial trucks, conveyors and hoists all in operation. The Material Handling Machinery Manufacturers Association and the Electric Hoist Manufacturers Association are cooperating with different makers in this particular exhibit. Among the processes of manufacture to be seen in actual operation are wood working, including furniture making, welding, japanning, heat treating, rivet heating, oil tempering and heating with vacuum furnaces. Complete processes will be shown in a bakery, a laundry, a refrigeration plant, battery charging plant, etc. Three types of machine shops will be operated and there will be a special exhibit showing factory lighting, particularly in regard to the factor of safety.

Gordon Bennett Entries of Other Countries

In addition to the three American entries, the Verville-Packard, Curtiss and Dayton-Wright as chronicled in the last issue, the entries of other countries to date include three machines each from England, France and Italy. Details of the Italian machines are not available, but England has entered a Sopwith, powered with a 450 h.p. Bristol Jupiter engine, and to be piloted by Harry G. Hawker, a Martinsyde with 300 Hispano-Suiza, pilot F. P. Raynham, and a Nieuport 320 A.B.C. pilot L. R. Tait Cox.

The French entries include a Nieuport to be driven by Sadi Lecointe, and two Spads piloted by Jean Casale and Bernard de Romanet, all with 320 h.p. Hispano-Suiza power plants.

This will make a most interesting race for the Nieuport and Spad machines are very similar, while Lecointe held the world's speed and altitude records until Casale took both away from him.

The Nieuport plane from such data as are available, will have a length of 19 ft., 8 in., a span of 18 ft., 2 in., a surface less than 140 sq. ft., a total weight of 2,002 lbs., and deducting the fuel weight of 350 lbs., a useful load carrying capacity of but 157 lbs. The Spad is a modification of the Herbemont 20, with a length of less than 24 ft., width about 30 ft., surface of approximately 183 sq. ft., total weight under 2,500 lbs., and useful load of about 300 lbs.

Of the 7,300 motor cycles actually in use in South Australia in December, 1919, nearly 60 per cent were from the United States, and of the 40 per cent from Europe the majority were from Great Britain.

The New and Unusual in the Automotive Field

New Double Disc Wheel Shows Maximum Strength and Other Advantages—Simple and Inexpensive Radiator Shutter for Small Cars—Adjustable Anti-Skid Chains for Trucks

It will be the policy of Automotive Manufacturer (as in Automotive Engineering) to present on these pages each month some car, truck, aeroplane, boat, tractor, engine or other unit which presents unusual and decidedly different engineering features

Indestructible Pressed Steel Double Disc Wheels

Slowly but surely the disc type of wheel is gaining in popularity as its many advantages become known to the general motoring public, and through their demands, to the manufacturers. There is no question of the superior appearance, impression of greater speed, lessening of labor in keeping the car clean, and other advantages, but for a long time the public has been skeptical about the strength of this form. The Indestructible wheel, which is shown in Fig. 1, is built on the principle that the triangle is the strongest known mechanical shape. Consequently, the design of this wheel was worked out to obtain a triangle. As the name of the wheel indicates, it is made with two discs, and these are widely separated at the hub. The two discs form two sides of the triangle, and the deep flanges, widely separated at the hub form, form the third

This wheel is equipped with Firestone demountable rim, the rim being the regular product that has been manufactured by Firestone people and is not a special proposition.

The valve stem in the wheel comes through at the back of both sheets and is in an indentation or recess in the sheet, so that the inflating nozzle can be applied to same It is not inside the disc where it is almost inaccessible as in most other double disc wheels.

The Indestructible Pressed Steel Double Disc Wheel is built on the triangle principle for the reason that the triangle is the one polygonal form whose shape cannot be changed without distorting one of its sides and when the load to be carried has been estimated the wheel recommendations become a problem of stresses and are solved by the application of the triangle and the method of moments.

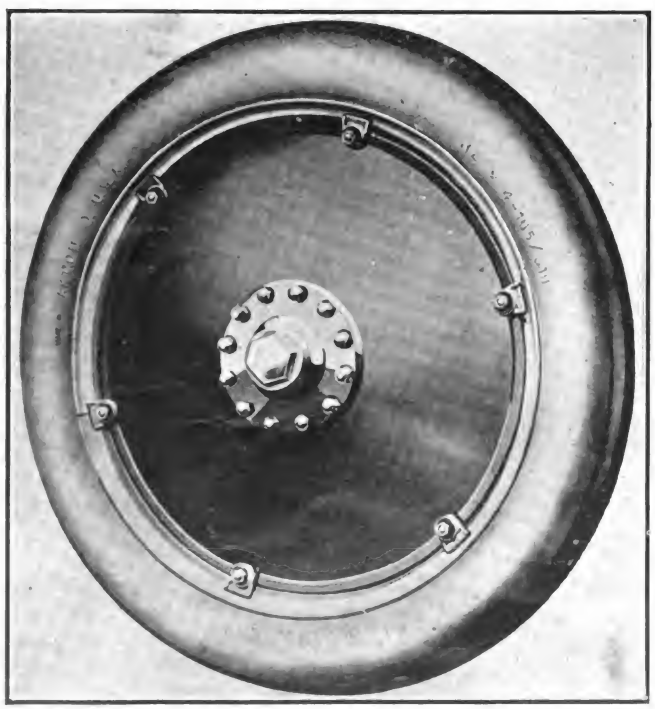

Fig. 1. Full side view of Indestructible Double Disc Pressed Steel Wheel

The double disc method of construction insures maximum strength with minimum of weight. The discs are made with long flanges, same being riveted to the felloe band, each supporting and strengthening the other. All road shock is taken up and distributed throughout the entire circumference of wheels.

At the moment either wheel strikes an obstruction, a glancing blow, or brushes against a curb stone, two opposed pressures immediately act to demolish the wheels, but the circular triangle bracing principle of the sheets in the wheel counteracts, cushions, and absorbs these forces. By the virtue of this construction, the wheel, as well as the motor vehicle parts, are safeguarded from damage by these forces when applied to the wheel at the rim.

Owing to the comparative lightness of this type of wheel, the minimum amount of power is used in putting them in motion as well as bringing them to rest when in motion. This means that clutches, universal joints, gears, and brake lining will last longer and are subjected to less wear and tear.

Owing to the symmetrical lines, this wheel is easier to paint and keep painted and is very easy to keep clean. The deep stamping steel has a very long fibrous molecular construction and it is the unseen fiber in the steel that gives strength and not the quantity. In its final form this has enabled a distinct gain in strength accompanied by the elimination of a considerable amount of material with no strength value. All material is put where it is needed.

In the riveting of the wheels the best procurable grade of rivets is used and no trouble from rivets is experienced.

The wheels being of the disc type, it is practically impossible for shock to be transmitted directly in full force to the hub barrel and thence to the bearing and the rest of the axle parts, as it is absorbed by the large area of the disc and is thereby dissipated. The appearance of motor vehicles equipped with disc wheels will impress the prospective purchaser, as they are symmetrical and very suggestive of strength. They do not carry or collect mud, snow, or ice and are exceptionally easy to keep clean. They are not subject to climatic conditions and will not swell, shrink or warp and do not become noisy because of unseen internal frictional forces which would in time cause their destruction.

By the use of these wheels decreased fuel consumption, increased tire mileage, splendid apparance, trueness of alignment, more strength, less weight, no flats, wheels al-

ways concentric, and a complete elimination of wheel troubles are claimed.

The Indestructible Wheel Company, Lebanon, Ind., manufacturers, have been making steel wheels since 1908.

Doty Radiator Shutter for Small Cars

The thermostat has become popular as a method of keeping the engine temperature just right, but this is extremely expensive to put on a car built without it, so some other less expensive device is needed. In the newly invented Doty radiator shutter, its manufacturers, the Auto Radiator Shutter Co., Dayton, O., seem to think that they have a device which is easily and quickly applied, is inexpensive, noiseless and gives practically all the advantages of the thermostat. As shown in Fig. 2, it consists

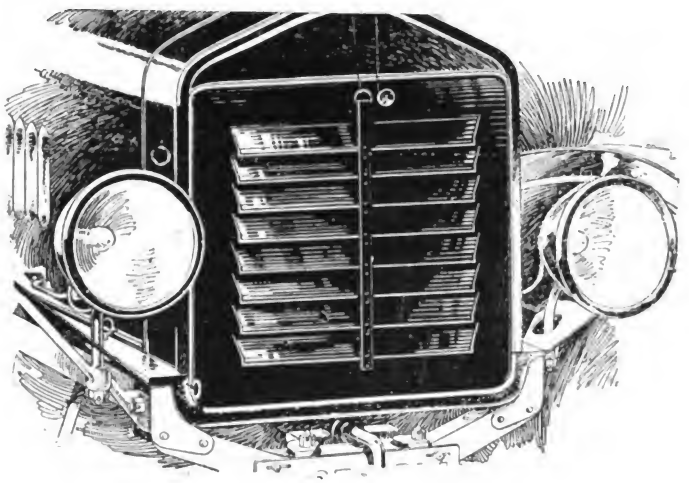

Fig. 2. Doty Radiator Shutter applied to small car

of a metal bound fiber plate which fits over the entire radiator front. This has the shutters made as an integral part of it, and these are perforated by means of a vertical band attached to each one and carrying a loop at the top.

This may be used in either of two ways, a cord or wire may be carried from the top of it across the top of the hood and through the cowl to the driver's position with a series of hooks or other fastening points there, or what is much more simple, the device carries near the top a projecting knob, to which the operating cord may be fastened. That is the cord may be looped around the radiator filling cap and back to this fastening knob. In this way it is a simple matter for the driver to fasten it to give the desired opening when he gets into the car. He has simply to consider the temperature and weather conditions, his engine performance, and set shutter accordingly.

Parker Anti-Skid Units

In really nasty weather, when the city streets are covered with glaring, slippery ice, the best of trucks, regardless of power, load or other things is useless without some form of anti-skidding device. One disadvantage of these devices as marketed in the past has been the time needed to put them on and take them off, making drivers reluctant to bother with them except under the very worst conditions. Consequently accidents frequently have happened in fairly bad weather, which could have been prevented by the use of non-skidding devices. The driver did not consider conditions sufficiently bad for him to exert himself to the extent of putting them on.

In the new Parker units, the makers, the Parker-Morse Co., Cincinnati, O., feel that they have a form of device which will obviate this and in addition, which presents a number of individual advantages. The complete Parker unit consists of a pliable steel clamping band, with an enlarged center portion, both ends being threaded, and a permanent spring steel anchor plate with two openings in it. The clamp is bent around the wood spokes of the truck wheel and the two ends pushed through the openings in the anchor plate. Spring washers and lock nuts are put in place and drawn up tight. These units can be put on in the quiet of the shop at any time, and in any convenient number per wheel, as two, four, six or more.

Normally the truck runs along with them in place, adding little or no weight, practically invisible, and having no projections to catch on anything, nor any other disadvantages. If then, conditions change so that a non-skid surface is required, the driver simply stops his truck, takes out the chains which are simply short length of special non-skid chain, tips up the locking anchor, slips one end over the vertical bar or hook of the anchor plates, draws the chain tight and slips the other end over, then turns the steel anchor to the locking position. This locking device is simply a tilting member on the projecting vertical end of the anchor plate.

This is shown in Fig. 3, where the chain is being put in place, with the lock opened. The whole operation can be done in a few seconds, while the beauty of the whole arrangement is that in moderately bad weather, the driver need not apply but two chains per wheel, in still worse weather he can put on three or four, when conditions are extremely bad he can put on six, eight or the maximum number for which the wheels are prepared.

In this way the number used, and with this the time spent putting them on and taking them off, can be varied to suit the conditions at the time. The advantages of this are obvious. The device is constructed throughout of special carbon steel drop forged, except the standard spring washers and standard steel nuts. If a length of chain be lost, broken or worn out, it is a simple matter to get another, all chain lengths are interchangeable, after the wheels are once fixed, any chain can be put on in any position at any time, and with a minimum of time and labor. When in place, and the need for them no longer exists, the chain lengths can be taken off even more quickly than they were put on. The anchors do not mar the wheels, and can be taken off in a few minutes. They will last a lifetime, and can be moved from one truck to another if desired in a short time. Only two sizes are made, No. 1 to fit square, round or oval spokes of two ton or smaller trucks, and No. 2 to fit any shaped spokes of three ton trucks and larger.

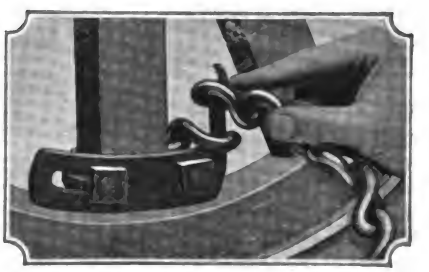

Fig. 3. Applying Parker Anti-Skid device to truck wheels

Presto-Felt Windshield Cleaner

With the approach of fall and winter, with spells of bad weather almost certain, especially misty, rainy and foggy days, when the windshield becomes covered quickly and vision sufficient to make driving safe becomes difficult, the thoughts of motorists and manufacturers natur-

ally turn to windshield cleaners, cleaning devices, preparations and the like.

An entirely new type of windshield cleaner is being made by The Presto-Felt Manufacturing Co., Toledo, O., called the Presto-Felt windshield cleaner. It is made with two chemically treated felt pads which are pressed against either side of the windshield by means of oil tempered, spring steel holders. These spring holders insure uniform tension, prevent rattling and keep the cleaner from dropping down in the line of vision.

As the windshield becomes thoroughly wet in a rain the cleaner, with its chemically treated pads, is swung back and forth across the glass three or four times until the action of the water causes the chemical to flow. Then as the felt pads wipe the water off the glass, they also deposit a very thin film of the chemical on the face of the glass, as a result of which the water does not stick to the glass and form in "beads," as it ordinarily does. Instead as soon as the rain strikes a "Presto-felted" windshield the drops of water flatten out, leaving a clean, "flat," transparent surface through which the driver can distinctly see the road and clearly distinguish objects ahead of the car. This result is in marked contrast to that of having the windshield constantly covered with "shimmering beads" of water through which it is almost impossible to see.

One cleaning is quite sufficient during any storm. Another important point is that the cleaner cleans both sides of the glass at the same time, thus preventing dust or steam from gathering on the inside of the windshield, particularly as with a closed car.

The cleaner is made in one model only, yet is so designed that it fits any and all types of windshields. It can be attached in either of three ways—clamping over the top of the windshield frame, bolted through the frame or bolted directly through the glass. All necessary parts are furnished with each cleaner for attaching in either of the three ways.

The several distinctive features possessed by the cleaner will quickly appeal to all drivers because of the universal difficulties encountered when driving during a rain. The unique manner in which it accomplishes the desired results is bound to find a ready response with most auto owners and drivers.

Facts Show World Uses Inches and Pounds

The metric system of weights and measures having made little progress in the industries of this country, its advocates are now endeavoring to force it by law on a people who have found little merit in it. The arguments are summed up in the terms: "World Uniformity" and "Foreign Trade." They start with what they consider an indisputable assumption that the metric system users form an overwhelming majority and that the bulk of trade is carried on in their system.

But facts are stubborn things and the facts indicate that the nearest approach to world uniformity in manufacture and trade has been achieved by nonmetric England and America. The overwhelming preponderance of British and American foreign and domestic trade and the dominating position held by their system of weights and measures in every commercial port have secured for them a universality, through natural processes, which no amount of compulsory legislation could have made possible.

We have only to remember that: 70 per cent of the world output of steel is manufactured in the United States and Great Britain on the inch and pound basis.

Approximately two-thirds of the world production of machine tools is made to the inch.

Eighty per cent of the world production of screw threads is made to the inch.

The United States and Canada consume for manufacture about 70 per cent of the world production of crude rubber.

The United States manufactures 90 per cent of the world production of motor vehicles.

The standard unit by which lumber is measured the world over is the board foot, being a board one foot square by one inch thick.

Ninety-five per cent of the world's cotton spindles are spinning to the yard and pound; only 5 per cent are spinning to metric.

The denier-aune is the world standard for raw silk and all efforts to substitute the metric standard have failed, even in metric countries.

Approximately two-thirds of the commerce of the world in manufactured products is on the basis of the English-American system of weights and measures.

Mail Contracts Let—Will Carry Passengers Too

What probably represents a new era in the aeronautic industry, as well as in the aerial carrying of mail, freight and passengers was inaugurated recently when the post office department signed a contract with the Lawson Air Line Co., Chicago, for the Pittsburgh, St. Louis route with stops at Columbus, Cincinnati and Indianapolis. This is to be begin in November.

Palatial air liners with wicker chairs inclosed in glass-windowed, streamline bodies, are being built for the new service, officials of the company announced.

The Government contract provides that each plane must carry 1,500 pounds of mail per trip. In addition the company is providing accommodations for sixteen passengers. this feature of the traffic being a private venture. Three hundred and six round trips are to be made yearly on each route.

Service on the New York-Chicago and New York-Atlanta routes probably will not be inaugurated until next spring. Connecting air lines between Cleveland and Detroit, Chicago and Indianapolis, probably will be opened later, when the company will also bid for mail carrying contracts.

A night service on the lines will be started and standard berths will be part of the equipment, Floyd K. Smith, assistant general manager of the company said. Shower baths and all modern conveniences will be installed, he added.

At the same time the department signed contracts with the same company for the New York-Chicago route via Harrisburgh, Pittsburgh and Ft. Wayne for $238,000 a year, and New York-Atlanta service via Washington, Raleigh and Columbia at $300,000 a year.

Sydney, New South Wales, Australia, is building its own motor fire engines because of the inability of the Fire Brigades board to import from 3 to 26 in the past five years, and in building these, it has been found impossible to save $2,400 over the best London quotation.

New Magnesium Alloy Shows Much Promise

Automotive Industry Will Welcome Lightest Metal Yet Available for Pistons and Similar Parts—Method of Manufacture—Physical Properties

IN the earliest days of the automobile and other automotive units, the best thought, brains, skill and money were concentrated upon making the machines run continuously regardless of size and weight. This was accomplished many years ago and since then engineers and executives have devoted the largest part of their time and effort to making the machines lighter in weight and less expensive to operate, yet equally reliable and serviceable. This has been brought about largely by the liberal, in some cases almost reckless, use of alloy steels, and more recently alloys of other metals. The stimulus of the war to aircraft and the manner in which the construction of aircraft was distributed all over the country for quick results taught many manufacturers the advantages of extremely light weight, especially the free use of the new aluminum alloys. A new metal, an alloy of aluminum and magnesium, which has been brought out by the Dow Chemical Co., Midland, Mich., deserves to be classified with these aluminum alloys for the simple reason that it is lighter than any of them and at the same time stronger and tougher than most of them. This is called Dow metal and is said to be the lightest metal known which is adapted to commercial uses. It contains over 90 per cent of metallic magnesium, which distinguishes it from all other light alloys now on the market. Others in the socalled aluminum family are composed largely of aluminum and contain magnesium, if at all, in small amounts. Magnesium is the lightest metal which at the same time has the tensile strength and the physical properties making it suitable for engineering uses.

This new alloy has been brought to the attention of engineers within the last two years. Prior to the war, magnesium was imported from Germany and its main, if not sole use, in the United States was as a deoxidizing agent for nonferrous metals. Dow metal is one-fourth the weight of cast iron and all aluminum and aluminum alloys are 50 per cent heavier, or it could be said, magnesium is one-third lighter than aluminum. A comparison of the three main piston materials as to weight in ounces per cubic inch, is as follows:

	Oz. per Cu. In.
Dow metal	1.04
Lynite	1.56
Cast iron	4.16

When the foreign supplies were cut off early in the war, the manufacture of metallic magnesium was undertaken by the Dow Chemical Co., there being unlimited amounts of the raw material in the brine pumped from its numerous wells, from which many other chemical products were manufactured. Among these manufactured products is the salt, magnesium chloride, which after suitable preparation is used for the manufacture of metallic magnesium. The process employed is electrolytic in which a heavy direct electric current is passed through a molten salt bath, maintained at a red heat until it is decomposed by the current and the metallic magnesium is formed which, on account of its extreme lightness, rises to the top, floats on the surface of the molten bath and is skimmed off from time to time.

Appreciating the fact that in the past the demand for magnesium was limited, because no alloy of it had been discovered which possessed the mechanical properties necessary for its use in practical construction of the parts in automotive and aircraft production where sufficient tensile strength with the other necessary qualities was needed, the Dow Chemical Co. established a research department and for the last five years or more this work has been carried on. Under the direction of Dr. W. R. Veazey, Case School of Applied Science, Cleveland, the chemists to make the first metallic magnesium at this plant were Messrs. Stafford, Collings, Burdick and Gann, and the alloying of this metal was then carried on by Veazey and Burdick until, after many tests, the present Dow metal alloy was obtained.

The main use found thus far for this alloy has been in the manufacture of pistons for automobiles and airplanes as well as motor boats. Possessing a tensile strength of from 22,000 to 25,000 lb. per sq. in., it is also the lightest material used for such purpose, besides having no abrasive or scoring action on cast iron cylinders and having approximately the same coefficient of expansion as other light piston alloys. Dow metal differs from aluminum as to the expansion under heat in a motor in that there is no permanent growth or set at these temperatures. Recent tests have shown that with 21 successive heats made of Dow metal for two hours each and for 0 to 800 deg. F the permanent growth is so minute that it cannot be detected with a micrometer.

In machining no cutting compound is used and with the lathe running at the highest speed, there is no tearing of the metal and no dulling of the tool by hard spots. The great resiliency of Dow metal is shown by recent tests at the Government laboratories at the McCook aircraft field, Dayton, O., in which an Oldsmobile piston was placed in a vise and forced in ¼ in. and upon being released from the vise, came back to size with the exception of being 0.004 in. out of round.

After the setup is made in the lathe, reports show that three Dow metal pistons are machined in the time formerly taken to machine one of cast iron of the same size.

The following table gives some of the more important physical properties:

Specific gravity	1.79
Tensile strength, lb. per sq. in.	22,000-25,000
Yield point, lb. per sq. in.	12,000-14,000
Compressive strength, lb. per sq. in.	45,000
Elongation, 2 in., per cent	3.5
Reduction of area, per cent	3.5
Modulus of elasticity	9,000,000
Brinell hardness	55-75

Where Dow metal is reworked or rolled, drawn, drop forged or heat treated, the tensile strength is increased at each operation. In heat treating, sand castings are increased from 22,000 to 25,000 up to 30,000 lb. per sq. in. or more, without causing any appreciable change in the yield point, while the elongation and reduction in area are increased to 6 per cent. In drop forging, the tensile strength is increased to 50,000 lb. per sq. in. and the Brinell hardness rises to 70 or better.

The heat conductivity is $0.295, as compared with 1,000

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Helpful Hints for Designers and Draftsmen

Strength of Welded Joints

Many people, even engineers, have so little actual knowledge of the welding process and the results obtained by means of it that they consider a welded joint much weaker than the other surrounding metal. That such is far from the actual case is shown by tests of some tie rods which were thermit welded at the plant of the Algoma Steel Corp., Sault Ste Marie, Canada. A total of such welds were made in 13 pieces of 3¼ in. square rod, each rod being welded in three places. Before making these welds a test was made on a plain, unwelded bar. The comparison of test results showed the following results:

	Tensile strength per sq. in. in pounds	Elongation in per cent
Original bar	48,560	52.5
No. 1—Thermit Weld	27,500	2.5
No. 2—Thermit Weld	52,200	6.0
No. 3—Thermit Weld	44,880	4.0

The low value obtained in Test No. 1 is explained as being due to a slight pipe in the sample which considerably reduced its tensile strength. Test No. 2 was made on an almost perfect weld and tested stronger than the original bar.

In preparing the sections for the tests, a piece of the 3¼ in. square rod 7 in. long containing the weld was cut out. This was put in a crank shaper and machined to flat surfaces on three sides, then put under power hack saw and quartered. Three of these quarters were then turned down to test pieces each having a cross sectional area of 0.7854 sq. in. or about 7½ per cent of the original bar. About 40 lb. of thermit was used to each weld and the preheating took about 2 hr. to each weld.

If the defective weld be eliminated, it will be noted that the two good welds averaged almost exactly the strength of the unwelded bar (48,540 lbs. against 48,560 lbs.), showing that properly made welds will give the full benefit of the original metal.

Automatic Stop for Machines

In the shop operation of many machine tools, a considerable waste is entailed when the operator fails to shut off the machine that is not in use even temporarily. A number of machines running idly eat up a whole lot of power, which means a considerable waste of coal in a year's time, and coal is precious nowadays. That it is possible to apply to such tools a simple and automatic shut- off which will conserve power and the tool itself to a certain extent, is shown by the illustration Fig. 1, and the following description from a Canadian Contemporary:

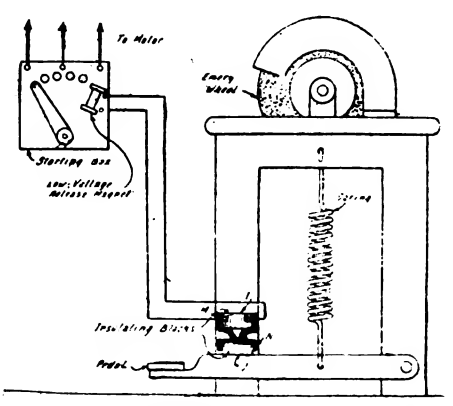

Fig. 1. Sketch showing application of automatic stop to grinder

"Grinders are high speed machines. The workmen often leave them running after they have finished grinding their tools. The result is that the wear on the bearings is excessive and considerable power is wasted.

"An automatic grinder stop, as illustrated, will eliminate these disadvantageous features. The scheme is of course applicable only on an individually motor driven grinder. A block of insulating material, I, was fastened to one of the legs of the grinder frame. To this block was secured two strips of sheet metal, M and M. Conductors were then wired as indicated, from each of these contacting strips, M and M, to the low voltage release magnet on the motor starter. The wires were fastened under the release magnet binding posts, providing an electrical connection. If a short circuit or shunt is arranged across M and M, the low voltage magnet is de-energized, and the starting handle is released. It will then return to the "off" position, and stop the motor. To effect this short circuiting automatically, the pedal illustrated was provided. On it was mounted an insulating block, J, carrying a strip of copper, N. When a man wishes to strat the grinder he first steps on the foot pedal. This removes the short circuit from around the release magnet. He then starts the motor in the usual way. When he has finished grinding his tool he must of course remove his foot from the pedal when he leaves the grinder. When he does so, N contacts with M and M, short cirsuits the low voltage coil and automatically stops the motor."

Although shown and described as a grinder, there is nothing about it which prevents its application in a similar manner to any tool which has intermittent and not continuous use.

Electric Pumps Working Under Water

We have long had pumping appliances which would work under water, drowned in fact, but none that were worked electrically. For a long time it was considered essential by electrical motor builders to keep "weather" from too close contact with their machines, and much ingenuity has been expended in the designing of protective covers suitable to the attainment of that end. All that is now past, and another milestone in the progress of electrical development has been left behind. A rotary pump, directly coupled to an electrical motor, was recently shown at Olympia which will work completely submerged. The motor is three-phase, 220 watts, with a short circuited rotor; and so far from any attempt being made to keep the water out of the motor, it is deliberately circulated through it, after being passed through a strainer to catch any gross mechanical impurities. The pump in fact takes its suction from water which has circulated through the motor. Needless to say, heating troubles are not likely to occur. The pump which was being introduced before the war proved extremely useful during that period, and a large number were supplied to the British and some of the allied navies.

More About Molybdenum in Automotive Work

When the success of the Renault baby type of tank was assured and it was decided to produce a large number of them in the United States, the American steel manufacturer who was to furnish the fabricated armor, developed

and submitted a turret and gun protector of flanged and formed armor plates ranging in thickness from 0.25 in. to 0.62½ in., which would afford ample protection to men and guns and would greatly reduce the weight and increase the space available to the operator.

The French engineers were pleased with this idea, but refused to believe it possible to form armor plate into the intricate shapes required, until a French commission had visited the manufacturer and had seen the parts produced in large quantities and on a commercial basis. This was perhaps the most notable development in the manufacture of light armor during the war.

This achievement was made possible by the use of nickel-molybdenum steel, which will be found equally effective in airplane, automobile, truck and tractor parts and all parts subjected to live loads.

Molybdenum in the form of the ferroalloy, may be introduced into steel by any of the customary methods. Recent developments have shown that molybdenum may also be introduced into steel in the form of calcium molybdate, with equal efficiency. This statement is based on the results of many commercial tests in open hearth and electric furnaces, made at both Government and private plants.

Already one of the foremost automotive engineers in this country, whose experience has primarialy been with quantity production, is starting to build an all molybdenum steel car. Others are adopting molybdenum steels for vital parts.

While molybdenum bearing ores are found widely distributed, the metal up to relatively few years ago was classed as semi-rare or semi-precious, as no deposits of real commercial magnitude had been discovered.

A few years ago the Climax Molybdenum Co. acquired possession of a deposit of molybdenum sulphide at Climax, Col. This ore body, by far the largest known, is of such extent and magnitude as to make molybdenum commercially available on a scale sufficient to meet all requirements of the steel trade. The flotation mill at Climax to treat the crude ore, has at present a capacity of 1,000 tons a day, and at this rate of production the ore reserves already developed insure steady operation for more than 30 years.

In this connection it is interesting to note that the supply of raw material from Canada is considerable. The supply in 1919 was curtailed by the collapse in the market for molybdenite, after the armistice. Incomplete returns from operators show that exports in that year were 113,520 pounds valued at $84,228 or an average value of 75.2 cents per pound.

The total production in 1918 representing the quantity of MoS_2 contents of the concentrates shipped for which payment was made amounted to 378,029 pounds which at $1.15 per pound would be worth $434,733.

The total shipments in 1918 of ores and concentrates were 461.3 tons valued at $428,807 and there were 33,935 tons of ore treated at the concentrating plants.

Most of the production has been derived from the mines at Quyon, Quebec.

The price of molybdenum in New York which averaged $2.25 per pound in January, 1918, gradually declined to $1 in August, 1918, and 87 cents in December. In 1919 the price declined to 75 cents per pound and sales were made as low as 50 cents and even 40 cents.

New Alloy Shows Much Promise

(Continued from page 33)

for pure copper and 0.108 for cast iron. The coefficient of linear expansion over a range from 0 to 800 deg F is 0.000028. This coefficient appears to be high for a material to be used in pistons. However this expansion is not accompanied by any permanent growth. In one test a bar was submitted to 21 heatings of two hours each at 800 deg. F, and it showed an increase in length of only 0.0003 in. per inch, an amount so small as not to be detected with the micrometer. In practice pistons are fitted to the same clearances in the cylinder as are commonly given to aluminum pistons and fitted in this manner, they have given entirely satisfactory service under all conditions.

The first real test of Dow metal pistons was made by the Dow Chemical Co. in its Ford roadster over a year ago. The car has been in constant service since that time and now has a mileage of over 20,000 miles and is still giving good service. At one time on a 5,000 mile test, the gas consumption was 23¼ miles per gal. and the oil at the rate of one quart for each 100 miles. At the conclusion of the test, the piston showed very little wear and the cylinder none. Since the original test set of pinions were put in, many additional sets have been installed by the company in its own test cars and by a large number of private car owners. The sound of the Ford motor with Dow metal pistons is hardly recognizable. Recent tests in a plant of a well known manufacturer of motors show that these motors developed 6 horsepower more with the Dow metal pistons than they had ever developed before with any other material. In spite of the rather ample clearances with which these pistons are installed in the cylinder, no case of oil pumping has yet been recorded and the objectionable piston slap is absent.

Motor Vehicle Owners Paying Heavy Taxes

According to R. E. Fulton, vice president of the International Motor Company, motor vehicle owners in 1918 paid $50,000,000 in automobile license fees to the various states. Including personal property taxes levied on cars in some states, excise and local charges, it is estimated that car owners paid no less than $150,000,000. In addition, motor vehicle manufacturers paid $33,000,000 in taxes to the Federal Government. This is a total of about $25 for every car built. Out of 2,500,000 miles of highway in the United States only 6,250 are equal to the demands of heavy duty traffic. Motor vehicles therefore pay a total sum amounting to $75 per mile for every mile of highway in the United States, improved or unimproved. For every mile capable of carrying heavy duty motor traffic motor vehicles pay yearly a sum equal to $24,000 per mile.

French Automobiles for American Market

A report from Paris says that French firms are considering the United States as a market for their cars. Mr. Pierre Bassett, representative of the Syndicat Francais des Constructeurs d'Automobiles, will leave France shortly to investigate conditions here.

Due to the French exchange situation and the low cost of freight space on ships returning to the Uuited States, Mr. Bassett expects to place French trucks on sale here at prices which will compare favorably with local prices Moreover many of the large French concerns have developed considerable technique in fast construction.

Current Automotive Metal and Supply Prices

General Conditions Business conditions the country over appear to have improved slightly in the past month. Money is easier, as the crop money has started to flow back east. In general material prices show a more marked tendency to decline, although building materials are still on too high a plane. Automotive plants are still reducing the number of employees, and there has been further retrenchment in rubber centers.

Iron and Steel For the second successive week pig iron shows no change in any quality or from any producing center. Sheet bars and blue annealed sheets are lower, and the general trend of iron and steel scrap is very apparently downward. The mills are busy, agricultural implement manufacturers having come into the market for large tonnages for 1921, while the railroads are beginning to buy. August ingot production was at the rate of 42,500,000 tons per year, a return to 1917 standards.

Copper and Aluminum Buying of copper is at low ebb, but some foreign buying on a very cautious scale lest prices be disturbed is beginning to be apparent. Leading aluminum interests show no change in prices, but others are said to be offering virgin metal as low as 30c, New York.

Lead and Tin Early September saw a not unexpected cut of ½c in lead, bringing it to 8.50c, New York. This was simply a readjustment of the leading interests' price to that in force among the other producers for some time. Imports from England continue on a fair scale. Consumers of tin are beginning to buy, and although prices show no change of recent date, there is a better feeling. Deliveries for August were 3,745 tons.

Zinc and Other Metals About all of the imported zinc has been sold and galvanizers are beginning to come into the market. These two things have given the market a better tone, but buying is still on a small scale. Ferrosilicon is down a considerable amount and can be had for about $165 a ton.

Old Metals All of the old metals are off somewhat, copper and brass scrap showing small changes, such as ¼c. Steel scrap is lower in Pittsburgh and Chicago, and cast iron scrap in Chicago.

Chemicals Caustic soda and soda ash are weak and lower. All grades of alcohol are lower than last month but the change is not recent. Naval stores are materially reduced, turpentine having lost 20c in the past month.

Other Materials The oils show no change although gasoline has been advanced 1c since the last quotation of prices. Stocks are said to be piling up however. The bottom seems to have fallen out of the rubber market, and the whole industry is in bad shape. Upriver fine is quoted at 28½c and the coarse and caucho are both below 20c. Hides are said to be moving more freely with some export demand. Bogotas are listed at 25c compared with last month's 30, and Bogota goat skins are 85 @ $1.00, which were $1 @ $1.10 last month.

Every effort is made to have the following prevailing prices (compared with last month's) accurate but none is guaranteed. They are obtained through trade sources and may not be realized on small quantities:

	Aug. 2	Sept. 13
Acid, Sulphuric, 66°.....ton	18.00 —20.00	$18.00 —20.00
Alcohol, Ethyl, 97 p.c.....gal.	5.00 — 7.00	6.00 — 7.00
Alcohol, denatured, 190 proof, gal.	1.05 — 1.10	1.05 — 1.10
Aluminum No. 1 99% carloads.lb.	.35 — .38	.35 — .38
Ammonium Chloride (Sal-Ammoniac) white, granular....lb.	.17 — .18	.17 — .18
Babbitt Metal, best grade.....lb.	.90	.90
Babbitt Metal, Commercial....lb.	.50	.50
Beeswax, natural crude, yellow.lb.		
Carnauba No. 1 Wax.....lb.	1.00 — 1.05	.90 — .95
Caustic Potash (85-92 p. c.)..lb.	.35 — .38	.29 — .33
Caustic Soda, 76 p. c.....100 lb.	6.27 — 7.00	5.75 — 6.00
Pumice, Ground (domestic)....lb.	.04 — .07	.04 — .07
Shellac, Orange, superfine....lb.	1.45	1.40 — 1.45
Tin, Metallic straits pig.....lb.	.53	.45
Turpentine, spirits of crude.....	1.69	1.49
Zinc, Western Spelter.....lb.	.10 — .11	.10 — .11
No. 9 base casks, open.....lb.	.15	.15

IRON AND STEEL, PIG, BARS, ALLOYS, OLD METAL

Pig, per ton—	Aug. 3	Sept. 14
No. 2 X, Philadelphia§.....	$49.15	$53.51
No. 2, Valley furnace†.....	46.00	50.00
Basic, delivered, eastern Pa.....	44.40	51.26
Basic, Valley furnace.....	46.50	48.50
Bessemer, Pittsburgh	48.40	50.46
Malleable, Valley	46.50	50.00
Refined iron bars, base price....	5.25c	5.75c
Soft Steel—		
¾ to 1⅞ in., round and square..	3.52—5.25c	3.63—5.40c
1 to 6 in. x ¼ and 5/16.....	3.62—5.25c	3.73—5.40c
Rods—⅝ and 11/16.....	3.57—5.05c	3.68—5.45c
Bands—1½ to 6 x 3/16 to No. 8..	4.22—6.50c	4.33—7.00c
Sheets		
Black, No. 28, Pittsburgh.....		7.50c
Galvanized, No. 28, Pittsburgh..		9.00c
Blue Annealed, 9 & 10.....		5.50c
Tin Plate, 100 lb. box, Pittsburgh		$9.00
Ferromanganese, 76% to 80% del.	$200.00	$165.00—170.00
Spiegel, 18% to 22% furnace, spot	75.00—85.00	80.00
Ferrosilicon, 50%, spot, delivered	70.00—80.00	75.00— 80.00
Old Metal		
Heavy steel scrap, Pittsburgh...	27.00	28.50
Heavy steel scrap, Philadelphia..	23.00	26.50
No. 1 cast, Pittsburgh.....	41.00	42.00
No. 1 cast, Philadelphia.....	38.00	40.00

†Silicon, 1.75 to 2.25. §Silicon, 2.25 to 2.75.

BOLTS AND NUTS

(Discounts are from Nov. 1, 1919)	Aug. 3	Sept. 14
Machine bolts, c.p.c. and t. nuts, ⅝ x 4in.; Smaller and shorter..	30	10
Carriage bolts, ⅜ x 6 in.:		
Smaller and shorter, rolled threads	30—10	20
Cut threads	30	20
Semi-finished hex. nuts:		
⅜ in. and larger.....	50—10	40
9/16 in. and smaller.....	50—10	40
Tire bolts	50	50

BRASS, COPPER SHEETS, SHAPES, VIRGIN METAL, SCRAP

	Aug. 3	Sept. 14
Copper, Lake, ingot.....lb.	$0.19	$0.19
Copper, Electrolytic .....lb.	.19	.186
Copper, Casting .....lb.	.18½	.18½
Copper sheets, hot rolled.....lb.	.33½	.33½
High brass wire and sheets....lb.	.30¼	.30¼
High brass rods.....lb.	.25	.27
Low brass wire and sheets....lb.	.27½	.28½
Low brass rods.....lb.	.29	.29
Seamless brass tubing.....lb.	.33	.33
Old Metal—		
Copper light and bottoms.....	.13¾—.14¼	.12½
Brass, heavy	.09½—.10	.09½
Brass, light	.07¼—.07¾	.07
No. 1 yellow brass turnings.....	.09 —.09½	.08¼
No. 1 red brass or comp. turnings	.12½—.13	.12½—.13½
Aluminum, cast.....		.20—.20½
Aluminum, sheet		.20—.20½

CRUDE RUBBER

	Aug. 2	Sept. 16
Para, Upriver fine.....lb.	$0.32 —.33	$ .28¼
Upriver coarse .....lb.	.23 —.24	.19½
Upriver caucho ball.....lb.	.23 —.24	.18½—.19
Plantation, first latex crepe...lb.	.32½	.26
Ribbed smoked sheets.....lb.	.31½	.23½
Brown crepe, thin, clean....lb.	.30	.23¾

PETROLEUM PRODUCTS

	Aug. 10	Sept. 16
Oil—Pennsylvania Crude	$6.10	$ 6.10
Kansas and Oklahoma Crude..	3.50	3.50
Gasoline, Motor, garages, steel bbls..	.30	.31
Consumers, steel bbls.....	.32	.33
Lubricating Oil, black, 29 gravity	.28—.33	.28—.33
Cyl. light filtered.....	.90—.95	.90—.95
Dark filtered	.83—.85	.83—.85

MEN OF THE AUTOMOTIVE INDUSTRY

Who They Are What They Are What They Are Doing

G. J. Brittain has been appointed vice president and general manager of the Canadian Fairbanks-Morse Co., Ltd., with headquarters in Montreal. He was formerly manager of the Winnipeg branch and succeeds C. G. Drinkwater who has been vice president in charge of sales for many years and who has resigned to enter the banking business. Brittain is succeeded in Winnipeg by Kenneth Forbes, who is in turn succeeded in St. John, N. B., by W. J. Hill. Other appointments are of Malcolm Cordell as Montreal manager; George L. Nies, Calgary manager, and Archibald Turner, Saskatoon manager.

E. R. Hollender, well known in the trade through his long connection with Fiat and other imported cars and more recently with Hollander Motors, Inc., one of the Ford agencies in New York city, has become a vice president of Gaston, Williams & Wigmore, exporters, New York city, and has already secured a number of well known men as associates in the big export firm. Coincident with this change, it is made known that Hollander Motors, Inc., will be dissolved August 1.

C. F. Drozeski, president and general manager Saginaw Malleable Iron Co., a subsidiary of General Motors Corp., has organized the Central Malleable Castings Co., in conjunction with his son and Mr. Kennedy, formerly foundry superintendent at Saginaw, and has purchased the foundry of the Franklin Park Foundry Co., at Franklin Park, near Chicago. Both gray iron and malleable castings will be produced.

Elisha Walker of Blair & Co., Inc., New York city, has been elected a director of the Willys-Overland Co. Walker's accession to the board was commented on in financial circles this week as a highly valuable one, and regarded as indicative of strengthing the company in the larger size which it has been assuming with the development of its new light four and its Willys-Knight models.

Fred Crebbin, Jr., formerly factory manager of the Master Trucks, Inc., has assumed his duties as general manager of the truck division of the Stoughton Wagon Co., Stoughton, Wis. Crebbin began his career with the Packard Motor Car Co., where he served several years as head of various departments. His experience also embraces connection with various other old names.

George William Sargent has severed his connection with the Crucible Steel Co. of America, Pittsburgh, where he held the office of vice president and metallurgist. He is now devoting his entire attention to the Molybdenum Corp. of America, 212 Empire Building, Pittsburgh, of which he is president. He holds the same office in the Electric Reduction Co., an affiliated organization.

E. L. Larson, works manager of the Locomobile Co. plant at Bridgeport, Conn., announces the appointment of C. H. McCarter as general superintendent of the Locomobile plant along with that of H. C. Aument as manager of the parts department. Other promotions include that of J. R. Stine to the position of car superintendent, and J. Burns, machine superintendent.

George H. Kleinert, who has served as general manager of its plant and vice president of the Bock Bearing Co. for nearly two years, has resigned that post, handing it over to Robert Clingman, sales manager, who now becomes acting general manager. Kleinert is withholding details of his future plans, save that it is his immediate intention to take a vacation.

Alfred K. Hebner was elected president and Dana H. Torrey secretary and treasurer of the Bearings Service Co., Detroit, Mich., at a recent special meeting of the board of directors, at which resignations of Ralph S. Lane, president; Harry J. Porter, treasurer, and Hebner, secretary, were tendered. Lane and Porter both continue as members of the board.

Allan A. Ryan, about whom Wall Street is still talking in connection with his Stutz Motor corner, has resigned as a director and chairman of the board of the Stromberg Carburetor Co. Though Ryan has made no explanation for this action, it is intimated from some sources that it is his intention to devote all of his time to his Stutz holdings.

L. R. German, well known throughout the trade through his association with the Olds Motor Works, Lansing, Mich., has been made a vice president and a director of that organization. German has been with the Olds organization for a long period and two years ago was elected comptroller of the company.

William D. Ennis has resigned as professor of marine and mechanical engineering in the Post Graduate Department of the United States Naval Academy to become vice president of the Techical Advisory Corporation of New York, with which he has been associated since its organization.

Fred P. Scribner, for manay years the superintendent of the Raybestos plant in Bridgeport, and for the last seven years superintendent of the F. L. Horton Mfg. Co., Boston, Mass., has taken an interest in the Staybestos Mfg. Co., Philadelphia, and is now superintendent of this plant.

James W. Powers, formerly with the Jaxon Steel Products Co., Jackson, Mich., has been made sales manager of the Motor Starter & Air Pump Co., Newark, N. J., maker of transmission driven tire pumps and air compressors. He will open offices in the Book Building, Detroit.

Otto H. Jobski has severed his connection with the Standard Parts Co., Cleveland, after 14 years of service in the capacity of mechanical engineer in the manufacture of rims, solid tire bases and tubular parts for automobiles. His future plans are not disclosed.

H. I. Crow, formerly aeronautical mechanical engineer in the production engineering department, Bureau of Aircraft Production, Dayton, O., has accepted a position with the Fageol Motors Co., Oakland, Cal., in its plant at 1827 East Eighty-ninth Street, Cleveland.

Harry A. Blair has been appointed vice president of the Studebaker corporation. L. J. Ollier, formerly vice president, who has just returned from abroad, will have charge of export sales. E. H. McCarty and H. S. Welch will be assistants to the vice president.

Frederick S. Duesenberg, who since the dissolution of the Duesenberg Motors Corp., Elizabeth, N. J., has been designing internal-combustion engines, has been appointed chief engineer of the Duesenberg Automobile & Motor Corp., Indianapolis.

Willard S. Mears has been elected vice president and treasurer of the Enameling & Stamping Corporation, Long Island City, N. Y. He was formerly general manager and vice president of the Oneida Motor Truck Co. of New York, New York city.

W. C. Schrage has been made president and treasurer of the Pittsburgh Shafting Co., of Detroit, and Thomas H. Booth has been promoted to vice president and general sales manager. Schrage joined the company fifteen years ago as bookkeeper.

Brilsford P. Flint has resigned his position of superintendent of the Yuba Mfg. Co., Benicia, Cal., and has accepted a similar position with the United States Fiber Products Co., 210 Capital National Bank Building, Sacramento, Cal.

A. Raymond White, formerly designing engineer in the engine department of the Curtiss Engineering Corp., Garden City, N. Y., has become an engine designer in the ordnance engineering laboratory of the Holt Mfg. Co., Peoria, Ill.

W. C. McCormick has been elected president and general manager of the newly incorporated McCormick Motor Car Co., Williamsport, Pa., which has been formed to take over the business formerly conducted under his own name.

R. H. Sanders has severed his connection with the Raymond Engineering Corp., New York city, and accepted a position as engine designer with the New York Rotary Motor Co., 25 West Forty-fifth Street, also of that city.

Otto Bruenauer has been elected vice president and made general manager of the Chicago Standard Axle Co., 1300 Fletcher Street, Chicago. He was formerly vice president of sales of the American Truck Co., also of that city.

Walter J. Baumgartner, who was formerly chief engineer and general superintendent of the Duplex Engine Governor Co., Brooklyn, N. Y., has accepted a position as engineer with the Garford Motor Truck Co., Lima, O.

William O. Olsen has severed his connection with the Arc'O Mfg. Co., Chicago, and is now designing production engineer for the William O. Olsen Co., 431 South Dearborn Street, Chicago, of which he is one of the organizers.

Frank A. Hayes has accepted the position of chief engineer with the Owen Magnetic Motor Car Corp., Wilkes-Barre, Pa. He formerly held a similar position with the International Fabricating Corp., also of that city.

Wayne E. Dunston has accepted the position of factory manager and chief engineer of the Kalamazoo Spring & Axle Co., Kalamazoo, Mich. He was formerly manager of the Crown Hardware Mfg. Co., Dayton, O.

H. W. Adams, formerly instructor of automotive gas tractor engineering in the City High Schools, Minneapolis, has accepted the position of superintendent of the Minneapolis Auto and Tractor School of that city.

C. M. Eason has been elected vice president of the Hyatt Roller Bearing Division of the General Motors Corp., Newark, N. J. He was formerly general manager of the Engineering Development Co., Moline, Ill.

George A. Shoemaker has been appointed works manager of the Bound Brook Oil-less Bearing Co., Bound Brook, N. J. Shoemaker was formerly connected in a similar capacity with Messrs. David Lupton Sons Co.

Fred J. Johnson has resigned his position as tractor designer with the Gray Tractor Co., Minneapolis, and has accepted a position as tractor and jig designer with the Crown Iron Works Co., also of that city.

Charles R. Short has accepted the position of engineer with the Dayton-Wright Division of the General Motors Corp., Dayton, O. He was formerly chief engineer of the Northway Motor & Mfg. Co., Detroit.

Harry E. Lambert has accepted a position as tractor engineer of the McDougall-Duluth Co., Duluth, Minn. He was formerly chief draftsman of the tractor department of the Pan Motor Co., St. Cloud, Minn.

Herbert B. Van Pelt, formerly vice president and manager of sales of the Pittsburgh Shafting Co. of Detroit, has organized the Service Steel Co., also of that city, to market seamless and welded steel tubing.

Ralph E. Cherry has accepted a position as engineer in the truck department of the Parrett Tractor Co., Chicago Heights, Ill. He was formerly chassis engineer with the Standard Steel Car Co., Pittsburgh.

Bruno Dahl has accepted a position as mechanical engineer with Abo Yern Manufaktur, Abo, Finland. He was formerly engineer in the automotive department of the Standard Steel Car Co., Pittsburgh.

D. M. Ackerlind has accepted a position as checker and layout draftsman with the Trego Automotive Corp., New Haven, Conn. He was formerly draftsman with the Nordyke & Marmon Co., Indianapolis.

Alvin M. Yocom has severed his connection with the Bethlehem Motors Corp., Bethlehem, Pa., as chief draftsman, to accept the position of chief engineer with the United States Axle Co., Pottstown, Pa.

E. Field White, formerly chief efficiency mechanical engineer of the Dort Motor Car Co., Flint, Mich., has accepted the position of chief of plant engineering with the Hudson Motor Car Co., Detroit.

G. E. Swartz has joined the Timken Detroit Axle Co., Detroit, Mich., in the capacity of manufacturing manager. Swartz was formerly mechanical superintendent of the Torbensen Axle Co.

ACTIVITIES OF AUTOMOTIVE MANUFACTURERS

Where They Are Located What They Are Doing How They Are Prospering

Wharton Motors Co., 914 Main Street, Dallas, Tex., has preliminary plans under way for the erection of a new plant in the vicinity of Jacksonville, Fla., for the manufacture of motor trucks. Bids for construction will be called early in the coming year and the initial works will cost about $650,000. The company will also build a plant at Dallas to cost about $400,000. As expansion is required the plant will be extended until the investment aggregates about $2,000,000. The company has arranged with the American Motors Export Co., Jacksonville, recently incorporated with a capital of $5,000,000, to handle the marketing of the production. J. R. Pratt is president of this latter organization; Thomas P. Wharton is head of the Wharton Motor Co.

General Motors Co. has followed the example of the Ford Motor Co. and has purchased several thousand acres of land in the vicinity of Norway, Mich. The deal is said to include water power and iron mines, and the property is only a few miles from the factory site purchased by the Fords near Iron Mountain. The Ford interests are now erecting a big sawmill and other factory buildings at Iron Mountain and will establish a plant there to employ 3,500 men. Ford has acquired 200,000 acres of land in the upper peninsula, including a number of mines and water power.

Stansell Motors, Ltd., Amherstberg, N. S. recently formed with a capital stock of $500,000, has secured a 10 year lease on a building erected several years ago for the manufacture of automobiles. At first only assembling will be done, but it is expected to go into the manufacture of cars at a later date. The directors of the company are: J. B. Whitley, Detroit, president; W. R. Stansell, Amherstberg, vice president and general manager; F. P. Davey, Detroit, secretary-treasurer. J. C. Veale, Detroit, and F. A. Parke, mayor of Amherstberg, are directors.

Vim Motor Truck Co., Twenty-third and Market Streets, Philadelphia, has effected a settlement and taken title to the former Midvale gun works, at Nicetown, heretofore held by the United States Ordnance Department. The property consists of a number of reinforced concrete buildings on a site comprising 27 acres, and will be used by the new owner for the manufacture of motor trucks and parts. It is planned to inaugurate operations early in December. The company's present building has been leased to the Philadelphia Electric Co.

Moline Plow Co., Moline, Ill., is to take over the commercial motor department of Root & Vandervoort Co., East Moline, Ill. The latter concern announced the separation of its automobile and engine departments a short time ago. No details of the deal have been announced but the plant is now closed for inventory and it is probable that the terms depend upon this. The Plow company have been large users of the R. & V. motors in their Universal tractor made at Rock Island, Ill.

Hunter Motor Car Co., 27 South Second Street, Harrisburg, Pa., recently organized to manufacture automobiles, will increase its capital stock to $121,000. Its proposed plant will be designed for a capacity of about 100 pleasure automobiles per month, and erection of the first unit will begin at an early date. The company has acquired an automobile machine shop where test work and other preliminary operations will be conducted. C. H. Hunter is president and general manager.

Jacquet Motor Corp., Manitowoc, Wis., has been incorporated for $100,000 to manufacture commercial vehicles, engines and parts. It is a reorganization of a Michigan corporation of similar name, now operating at Belding, Mich., which is transferring its plant and offices to Manitowoc. The incorporators of the new concern are: Alfred J. Jackson, Belding, and Frank M. Kadow and H. B. Kamschulte of Manitowoc.

Climber Motor Corp., Little Rock, Ark., is having some difficulties with stockholders, a small group of which is asking for a receiver. Mismanagement is charged, fraudulent representations in the sale of stock, and illegal increase in capital stock. The officers claim the trouble is due to a discharged and disgruntled employee, who has circulated slanderous reports about the product and the officials.

Highland Automobile Co., Pittsburgh, has acquired considerable property on Liberty Avenue, near the Baum Boulevard, and is negotiating for further purchases. The acquisition up to the present time totals about $110,000 in valuation, and a site to cost about $35,000 is expected to be added to the holdings. The company is said to have plans under way for new works to cost in excess of $250,000.

International Motor Truck Co., New York, N. Y. with plants at Plainfield, N. J., and Allentown, Pa., has arranged for expanding its production from 10,000 to 15,000 trucks per year. It is taking bids for a one story addition to the Allentown plant, 300 x 500 ft. In addition, the former plant of the Wright-Martin Aircraft Corp. at New Brunswick, N. J., is now operating.

Huffman Bros. Motor Co., Omaha, Neb., has had a petition filed against it and its officers by certain stockholders. The latter claim conspiracy to defraud stockholders as well as mismanagement. The defendant company has a plant at Elkhart, Ind., but the business is directed from Omaha. It is the manufacturer of both trucks and passenger cars.

Kissel Motor Car Co., Hartford, Wis., manufacturer of passenger and commercial vehicles, has increased its capital stock from $1,000,000 to $2,100,000 to accommodate the development of its business and finance extensions and new equipment installed in the last six months. For the present no further additions will be undertaken.

Root & Vandevoort Co., East Moline, Ill., announce enlargement and extensions to its automobile plant, following the disposal of its engine department to the Moline Plow Co. It is expected that this deal will involve three or four million dollars, the larger part of which will be put back into the automobile plant.

Gloria Motors Corp., 407 Shubert Building, Philadelphia, manufacturer of automobiles, is completing plans for its new plant in the vicinity of Audalusia Street and the Pennsylvania Railroad. The initial works will be two stories, 200 x 400 ft., estimated to cost in excess of $500,000, including equipment.

Jones Motor Car Co., Wichita, Kan., is having difficulties in disposing of motor car credit paper to banks, and as a result, a receiver for the firm has been asked. The company is declared solvent but the officials have agreed to the receiver to operate while money is tight

Craig-Hunt Motor Co., Indianapolis, Ind., a new concern which will market a car around $1,000, will have these manufactured at the plant of the Rapid Rim Co., Huntington. The new car will be shown at the fall show in Indianapolis.

Harley-Davidson Motor Co., is erecting a one story addition, 47 x 216 ft., to its main works at Thirty-seventh and Chestnut Streets to cost about $60,000. The Federal Engineering Co., 442 Milwaukee Street, is architect and engineer.

Southern Motor Mfg. Association, Houston, Tex., is planning for the erection of two additions, one story, 120 x 480 ft., and 75 x 150 ft., respectively. The larger structure will be equipped for the manufacture of pleasure automobiles.

Mutual Truck Co., Sullivan, Ind., will begin work about Sept. 15 on a new factory building east of the present plant. This is to be followed by the erection of an office building. The estimated cost of these two buildings is $85,000.

J. I. Case Plow Works, Racine, Wis., has started work on the construction of a four story factory, 123 x 138 ft. at Mead and Water Streets, to be used mainly for manufacturing motor trucks for farm purposes.

Willys-Overland Co., Toledo, O., is placing contracts for a new foundry at Fostoria, O., to make castings for the Auto-Lite Co., an allied organization. It will be of brick and steel, 141 x 241 ft.

Pioneer Truck Co., Valparaiso, Ind., has completed arrangements for a new plant, the first unit of which will be 100 x 300 ft. Otto M. Freier is president and Richard Vogel, secretary.

Atlas Tractor Co., Detroit, will move its plant to Adrian, Mich., and change its name to the Adrian Tractor Co. A plant will be erected with a floor space of 12,500 sq. ft.

Hahn Motor Truck Co., Hamburg, Pa., manufacturer of motor trucks and bodies, has increased its capital from $50,000 to $200,000. W. G. Hahn is president.

Oneida Motor Truck Co., Green Bay, Wis., on Aug. 1 took occupancy of its No. 2 factory, duplicating the original plant and costing about $175,000.

Transport Truck Co., Mount Pleasant, Mich., manufacturer of motor trucks, is planning a new one story addition, 90 x 240 ft.

Geronimo Automobile Co., Elk City, Kan., factory was competely gutted by fire recently, with a loss of $250,000.

Mobile Tractor Co., Mobile, Ala., will build an additional plant unit for the manufacture of farm tractors.

Parts Makers

Briggs & Turivas, Inc., operators in scrap iron and allied metals, iron and steel products obsolete and salvageable material and equipment, Chicago, New York and Toronto, Canada, have produced a pocket size 48-page booklet with much valuable information for the producer and user of these materials. Under the title "Classified Scrap Iron," the booklet has been prepared and arranged for the utmost convenience of reference. Attention is called to the fact that proper classification adds to the market value of scrap and following this is a classification, worded without technicalities, describing various grades of iron and steel scrap as marketed.

Dunlop, America, Buffalo, new plant now in course of construction in the River Road district, will be devoted to the manufacture of cord automobile tires, giving employment to about 7,000 operatives for initial operations. It is expected later to increase the force to about 10,000. It will operate on a 24 hr. basis for some time after production has begun. The operating department will be composed of George R. Johnson, factory manager; John Flower, engineering department; C. R. Redfield, in charge of production, and C. L. Landon, sales manager. Perry D. Saylor is vice president and general manager.

L. I. Yeomans, formerly vice president Amalgamated Machinery Corporation, Chicago, has joined with others in organizing the American Metal Products Co., which is equipping a shop at 1331 West Washington Boulevard, for the manufacture of automotive parts. The company has bought machine tools and will commence production in a few weeks. Mr. Yeomans is president.

Arrigoni-Pfeiffer Motors, Inc., New York, has been incorporated with a capital of $50,000 by A. Arrigoni, E. Leindorf and A. Pfeiffer, 152 East Ninety-second Street, to manufacture motor truck parts, etc.

S. K. F. Ball Bearing Co., Hartford, Conn., officials have under consideration a plan calling for the erection of an addition to be used for work now done at the Worcester, Mass. plant.

Champion Ignition Co., Flint, Mich., manufacturer of spark plugs and ignition equipment, has completed plans for a new power plant for works service, to cost $60,000.

M. & S. Radiator Co., Albany, N. Y., has been organized by G. E. and A. N. Sperry to manufacture radiators for automobiles and other sheet metal products.

Van Wheel Corporation, Syracuse, N. Y., manufacturer of automobile wheels, has increased its capital from $125,000 to $250,000.

Kalamazoo Spring & Axle Co., Kalamazoo, Mich., plans to increase its capacity six-fold, according to Christian Girl, president, and the entire plant will be remodeled. Considerable new machinery has been purchased. The name will be changed to the C. G. Spring Co., and it will be capitalized at $100,000, with 10,000 shares of common stock of no par value.

Halliday Mfg. Co., manufacturer of shock absorbers and other automobile accessories, Streator, Ill., recently established a temporary factory at Decatur, and has bought a site for a new plant in the latter city, 218 x 560 ft., on North Third Street, near East Eldorado Street. The first factory unit will be erected at once at a cost of $75,000.

Piston Ring Co., Eau Clair, Wis., a new corporation with $25,000 capital has leased space and is buying equipment for manufacturing piston rings for explosive engines, as well as other automotive parts and accessories. It is hoped to get into production by Sept. 1 or 15. C. M. Pratt and E. L. Ross will be active managers of the business.

American Bosch Magneto Co., Springfield, Mass., have perfected arrangements for an executive control of Gray & Davis, Inc., Boston, manufacturer of starting and lighting systems for automobiles. The Bosch company will also act as exclusive selling agent for the products of the Gray & Davis interests. Plans are under way for enlargements in the plants.

Van Briggle Motor Device Co., Indianapolis, Ind., has increased its capital stock from $500,000 to $800,000, and will build a new plant at Mooresville, Ind., estimated to cost about $200,000, including equipment. The factory will be two and three stories. C. E. Bacon, 617 Merchants Bank Building, Indianapolis, is architect.

Vaporetor Corp., Milwaukee, has been incorporated with a capital stock of $300,000 to manufacture automotive equipment, accessories, and parts. The incorporators are represented by Nathan W. Klein, James Barels and Thomas T. Churchill, attorney, 425 East Water Street. Further details are not yet available.

Ajax Rubber Co., Inc., New York, reports greatest volume of business in the company's history, the six months ending June 30, 1920, exceeding the first six months of the fiscal year by 16 per cent net. A substantial amount has been added to the surplus account which now stands at $3,000,000.

Colonial Radiators, Ltd., Hamilton, Ont., has been incorporated with a capital stock of $40,000 by James N. Bicknell, 95 Strathmore Boulevard; Albert O. L. Burnese, 109 Neville Park Boulevard; Robert J. O'Reilly and others, all of Toronto, to manufacture motor vehicles, radiators, fenders, etc.

Leeds & Northrup Co., 4901 Stenton Avenue, Philadelphia, manufacturer of electrical measuring instruments, has taken title to about three acres on Germantown Avenue, near Wayne Junction, for a consideration of about $35,000. The site will be used for the erection of a new plant.

Electric Storage Battery Co., Nineteenth and Allegheny Streets, Philadelphia, has filed plans for a one story addition on Rising Sun Lane, near Adams Road, to cost about $20,000. Plans for a new three story brick and concrete plant to cost $192,000, have also been completed.

Automobile Products Co., Waukesha, Wis., has been organized with a capital stock of $10,000, by George L. Rock, S. Breeze, Jr., G. W. Tassell and R. P. Breeze, to manufacture automotive parts and accessories. A factory is to be established immediately.

Columbia Machine Works, 2122 Main Street, Columbia, S. C., recently organized, will operate a plant for the manufacture of automobile gears, axles and kindred specialties. J. E. R. Goodman is president and manager and W. W. Goodman, secretary.

Farrington & White, Inc., South Elm Street, Greensboro, N. C., is planning for the installation of new foundry equipment and will establish a department for the manufacture of automobile parts, accessories, etc. A. O. White is manager.

Motor Truck Radiator & Mfg. Co., New York, has been incorporated with an active capital of $55,000 by G. W. Geiling, D. DeW. Wever and T. D. Hartigan, 2 Wall Street, to manufacture automobile radiators and other metal specialties.

Reynolds Motor Co., Carnegie, Pa., has been incorporated in Delaware with capital of $100,000 by H. J. Hoban and E. G. Welch, Carnegie, and W. E. Pfaller, Grafton, Pa., to manufacture automobile parts and equipment.

Smith Wheel Co., 100 North Geddes Street, Syracuse, manufacturer of automobile wheels, rims, etc., has awarded a contract to Dawson Bros., Union Building, for a two story addition, 62 x 70 ft., and 40 x 106 ft.

Liberty Mfg. Co., New Haven, Conn., will increase its capital stock from $250,000 to $3,000,000 and move to Bridgeport, Conn., where it will enter into the manufacture of a new air-cooled motor for automobiles.

Brown-Lipe Gear Co., 1117 West Fayette Street, Syracuse, N. Y., manufacturer of automobile transmissions, has awarded a contract to Henry Shenck, Erie, Pa., for an addition to cost about $100,000.

Sauzedde Wire Wheel Corp. have completed plans for the erection of a plant in Mt. Clemens, Mich. The first unit will cost about $50,000 and will have a capacity of 3,500 sets of wire wheels a year.

Trans-Marine Motor Corp., New York, has been incorporated with a capital of $100,000 by J. A. Lee, O. Sperling and G. Pfell, 149 Broadway, to manufacture motors and parts for automobiles and boats.

Georgia Republic Co., Macon, Ga., has been incorporated with a capital of $50,000 by T. E. Turner, J. L. Sovars and R. M. Yatlin to manufacture motor truck parts and other similar products.

Marvel Shock Absorber Co., Portland, has been incorporated by S. L. Savidge, A. W. Regner and J. D. Gulss with a capital stock of $1,000,000 to manufacture automobile parts and accessories.

Standard Carburetor Co., Los Angeles, has been incorporated with a capital of $25,000 by W. D. Keefer, C. F. Degner and F. A. Sutphen, to manufacture carburetors and similar specialties.

Continental Piston Corp., Detroit, will move its plant to Midland, Mich., where it will occupy a part of the aircraft parts building. It machines rough piston castings for the Dow Metal Co.

Zenith Carburetor Co., Hart Avenue, Detroit, manufacturer of carburetors and similar specialties, will soon award contract for a two story addition, 60 x 117 ft., to cost about $70,000.

Economy Mfg. Co., 886 Main Street, Bridgeport, Conn., manufacturer of spark plugs, is arranging for the construction of a new plant on Brewster Street, to cost about $75,000.

Holzer-Cabor Electric Co., Jamaica Plain, Boston, will soon award a contract for a one story 46 x 78 ft. manufacturing building.

Body Builders

John Immel & Sons, closed body manufacturers, Columbus, O., is to be reorganized and refinanced. By this A. F. Beck becomes president and general manager; George M. Sunday of Chicago, son of Billy Sunday, the celebrated evangelist, vice president in charge of sales and operations; Minor Wilson, secretary; Roger B. Allen, treasurer; V. L. Decker, production manager, and W. M. Miller, assistant general manager. The company is just completing a large modern plant which has approximately 240,000 ft. of floor space. About 25 per cent of the woodworking machinery has been installed and practically all of the metal working machinery is in place. Dry kilns and a boiler plant will be completed in about six months, when it is expected to have the output up to 65 bodies daily. The company has booked large contracts for closed bodies with the Liberty, Velie and National companies.

American Motor Body Mfg. Corp., New York, is the new name of the consolidation of the Wadsworth Mfg. Co., Detroit, and Hale & Kilburn Corp., Philadelphia, Edward C. Budd, president of Hale & Kilburn, will be president, and voting control of the company will be vested in voting trustees, two-thirds of whom would be named by the American Can Co., which is heavily interested. This new combination foreshadows a closer combination of the interests of John N. Willys, the American Can Co. group, the Maxwell-Chalmers organization and the Chase National Bank (N. Y.) crowd, the latter in turn being interested in Bethlehem Motors, Gray & Davis, Amer. Bosch Magneto, and other automotive concerns.

Heil Co., Twenty-sixth and Montana Avenues, Milwaukee, is in the market for equipment for a one story brick and steel shop addition, 136 x 275 ft., foundations for which are being completed. A contract for two 10 ton cranes, 40 ft. and 50 ft. respectively, has been placed with the Pawling & Harnischfeger Co., Milwaukee. A 12 ft. power brake suitable for ⅜-in. material has been purchased from the Dries & Krump Mfg. Co., Chicago. A 1 in. punch for ½-in. material, a ½-in. gate shear, and a 150-250 h.p. boiler are other requirements not yet placed. The Heil Co. manufactures tanks, dump bodies for motor trucks, hydraulic hoists, etc. Julius P. Heil is vice president and general manger.

Field Body Corp., Owosso, Mich., is installing a new power plant which will furnish heat, light and power for the entire plant, preventing a recurrence of the handicaps under which the company has labored in the past. The company has just sent out checks for the first quarterly dividend on the stock issued recently. The stock pays 8 per cent annually. Of the $200,000 issued $155,000 has been sold, all but $40,000 of which was taken by investors in Owosso. The other $40,000 has been taken by company employees.

Schmidt & Stork Wagon Co., West Bend, Wis., has decided to begin at once with the erection of its new factory building in the southern part of the city. The building to be erected will be 100 x 270 ft. in size, of concrete construction, with asbestos roof. Aside from this building there will be an extra boiler room and dry kilns. The contract has as yet not been let. The new spur railroad track, leading from the main line into the new yards, was finished last week.

Racine Mfg. Co., Racine, Wis., manufacturer of automobile bodies, has curtailed an extensive enlargement program adopted when it passed into the control of the McCord Mfg. Co., Detroit, several months ago. However a dry kiln addition of 14 units, and additional boiler capacity to serve the kilns will be made immediately. Two 300 h.p. boilers, with automatic stokers will be required. C. F. Brandt is general manager.

Carriage Builder's National Association forty-eighth annual convention will be held at Richmond, Va., Oct. 19 to 22, 1920. Headquarters will be at the Hotel Jefferson, where the exhibition of automobiles, parts of vehicles, models, new inventions, harness and horse equipment and materials pertaining to the automobile and accessory, carriage and wagon industries will also be held.

Morgan Mfg. Co., Philadelphia, a New York corporation, has changed its name to the Chester Body Co. It recently acquired property at Chester, Pa., for the erection of a new plant for the manufacture of automobiles, including bodies, parts, etc. James L. Morgan, Overbrook, Pa., is president, and Harry C. Robinson, Chester, secretary and treasurer.

Brown Auto Body Co. has leased from the Cleveland Belting & Machinery Co. a parcel on the north side of Fairfield Avenue, Cleveland, O. Under the lease terms the Cleveland company will erect for the auto body company a building that will contain 15,000 sq. ft. of floor space on one floor. The building will be erected directly west of the new building.

Continental Piston Ring Co., Memphis, Tenn., has awarded a contract to the Fisher Lime & Cement Co., Memphis, for a new one story plant, 153 x 217 ft. A large portion of the structure will be used as a machine shop. It is proposed to develop a capacity of about 600,000 piston rings a month. B. G. Covington is president and general manager.

Mercury Body Corporation, 705 Security Trust Building, Lexington, Ky., recently incorporated with a capital of $100,000, has leased a building and will establish a plant for the manufacture of automobile bodies. The initial machinery installation is estimated to cost about $20,000. K. G. Pulliam, Sr., is president.

United Auto Body Mfg. Co., 100 Hamilton Street, Rahway, N. J., owing to a recent zoning ordinance prohibiting the erection of a proposed addition to its plant, is considering the removal of its automobile body works to Linden, N. J., where options have been taken on property. E. L. Mohn is president.

Ohio Crank Shaft Co., Cleveland, has been organized by W. C. Dunne, formerly production manager of the H. J. Walker Co., and will establish a plant for the manufacture of automobile crank shafts. Considerable machine tool equipment will be required and orders are now being placed.

Bock Bearing Co., Phillips Avenue, Columbus, manufacturer of automobile bearings, a subsidiary of the Standard Parts Co., Cleveland, is having plans prepared for a two story and basement addition, 60 x 260 ft. to cost about $100,000.

Walker Body Co. is the new name of the Walker-Wells Co., Amesbury, Mass., manufacturers of automobile bodies. The interests of the late Harlan P. Wells have been purchased by the H. H. Franklin Mfg. Co., Syracuse, N. Y.

Maryland Auto-Products Co., Hagerstown, Md., has been incorporated with a capital stock of $50,000 by James J. Boyle, John M. Hammersla and George E. Slaybough to manufacture automobile parts and other motor equipment.

Indianapolis Body Corp., Indianapolis, Ind., are defendants in a suit by the People's Coal & Cement Co., which has asked the appointment of a receiver. It is charged in the complaint that the corporation has many debts which are overdue. George F. Cottrill, president, and F. H. Vogel, assistant treasurer, both of St. Louis, Mo., are named as defendants in the suit.

Dayton Body & Cabinet Co., Dayton, O., has been incorporated at $50,000 to manufacture commercial bodies for trucks and automobiles. Among the men behind the new enterprise are C. C. Breech, D. L. Waggoner, D. L. King, J. Davies and V. B. Duvall. The new concern with several locations in view, hopes to be in operation by the first of next month.

Lundin-Brugger Co., Fond du Lac, Wis., manufacturer of closed bodies for open passenger automobiles has increased its capital stock from $120,000 to $240,000. It moved into its new factory May 25. The new issue will be used to finance the new plant, equipment and raw materials. Current orders amount to $500,000.

Dayton Body & Cabinet Co., Dayton, O., recently incorporated with a capital of $50,000, has taken over the Colonial distillery building at Trebeins near Xenia, O., and after alterations are completed will install equipment for the manufacture of commercial automobiles. C. C. Breech is president.

Perfect Body Co., 315 West 47th Street, New York, has been petitioned into bankruptcy.

Index To Advertisers

WANTS

WANTED

Body Draftsmen—First class men, familiar with full size production draughts; permanent position; when replying state in detail your experience, age and salary expected. The Locomobile Company, Bridgeport, Conn.

WANTED—Mechanical draftsman or designer familiar with tractor or truck. Write giving age, experience and salary expected. Emerson-Brantinghan Co., 2723 University Ave., S. E. Tractor Works, Minneapolis, Minn.

PATENTS

Patents—H. W. T. Jenner, patent attorney and mechanical expert, 622 F St., Washington, D. C. Established 1883. I make an examination and report if a patent can be had and exactly what it will cost. Send for circular.

The Automotive Manufacturer

The Hub of Automotive Engineering

BODY BUILDING - AUTOMOTIVE PARTS - ALLIED INDUSTRIES

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The Automotive Manufacturer

The Hub ← A CONSOLIDATION OF → AUTOMOTIVE ENGINEERING

Vol. LXII NEW YORK, OCTOBER, 1920 No. 7

More Powerful 1921 Buicks Present Detailed Refinements

Very Few Changes as Compared with 1920 Models—Refinements Free Driver of Need for Adjustment and Attention—More Graceful Bodies

TO the casual observer the 1921 Buick cars will show very little difference from the 1920 types, but among the changes made are some in the body lines at top, radiator, cowl and hood, as well as filler piece between step and body. These lines seem to make the car much longer Compared with the cars of this year they look to have at least 4 inches more wheelbase, yet the wheelbase is unchanged. More than this long and low appearance, the changes which have been made blend the chassis and body into a more harmonious unit, and give it a much more graceful appearance. Those who know the capabilities of Buick cars in the way of power and ruggedness, that is sheer mechanical goodness and brute power, will be much pleased with this new body design which adds to that, superior appearance.

Prices have not been reduced, and as compared with the announced prices of a year ago, show an average increase of about $400. There are seven body styles as follows: three passenger roadster, five passenger touring, four passenger coupe and five passenger sedan, all on the shorter wheelbase chassis which is 118 in.; four passenger coupe with folding and disappearing extra seat (an entirely new form), seven passenger touring, and seven passenger sedan, all of the long wheelbase chassis of 124 in. Apparently the long wheelbase seven passenger touring is expected to be the most popular, or else the price has been kept down so as to make it most popular for this shows the smallest increase, only $280 over last year. The three passenger roadster and five passenger touring on the 118 in. wheelbase chassis come next with but $300 increase over their 1920 prototypes. The shipping weights, it should be mentioned, are unchanged, so that whatever

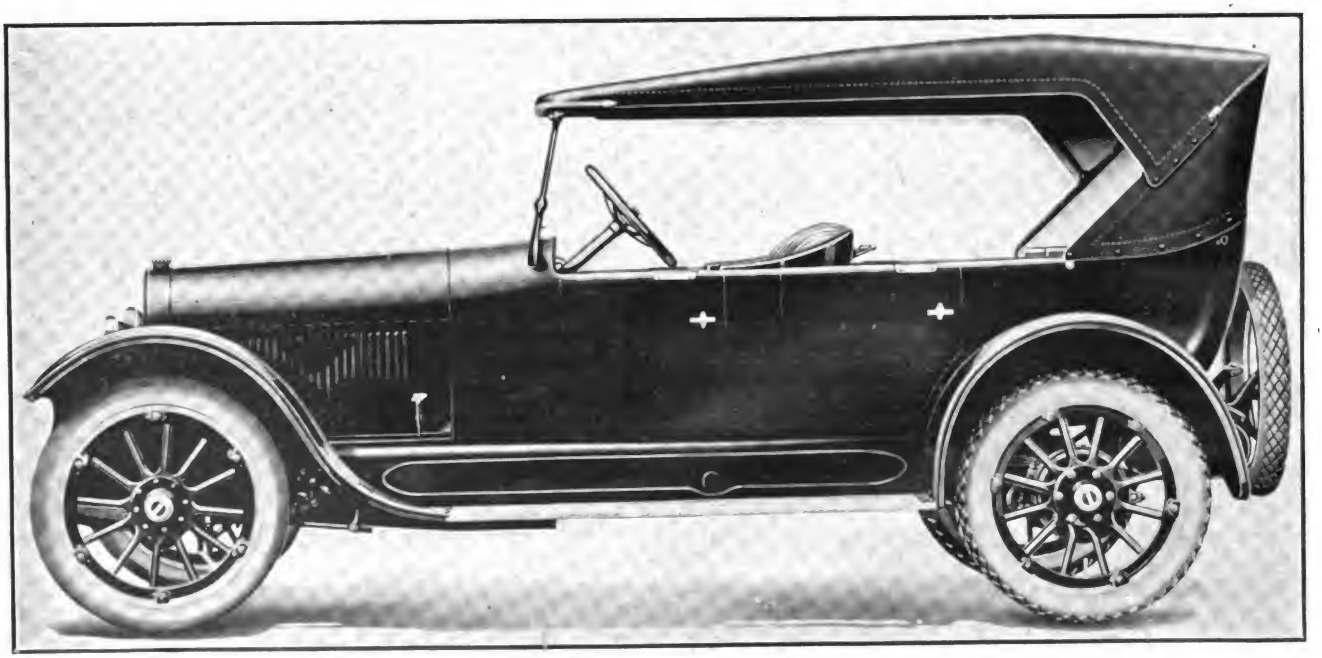


Fig. 1. Side view and general appearance of the Buick 21-45 five passenger touring car, typical of the 1921 line

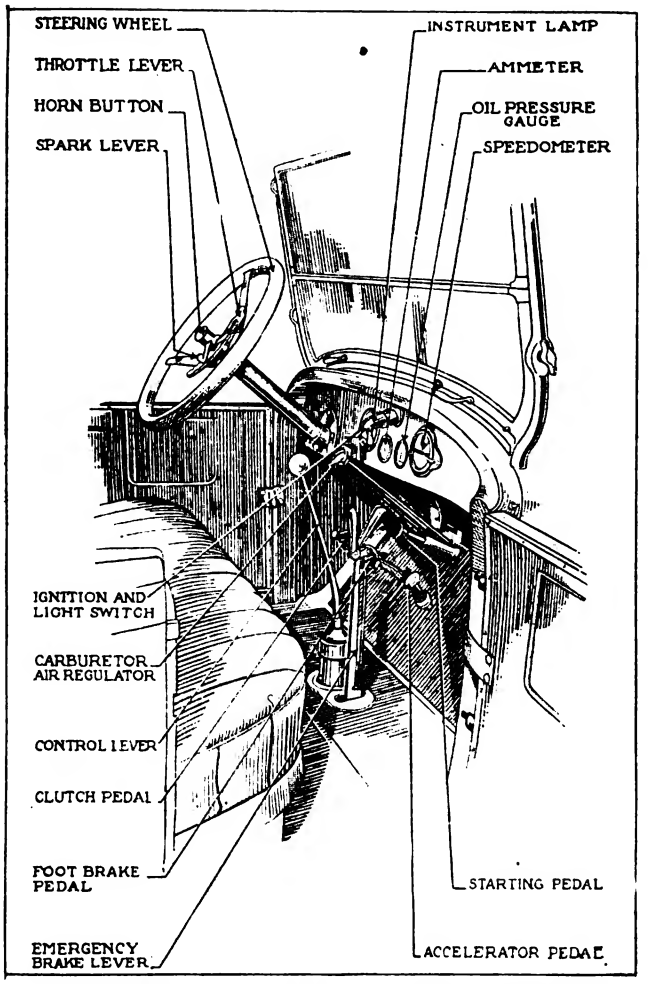


Fig. 2. Driver's compartment showing convenient arrangement of pedals, levers and instruments

power has been added by detail refinements in the motor adds to the performance of the car.

The five passenger touring car shown in Fig 1 will give a splendid idea of the appearance of the whole line, in addition to which the drawings shown in Fig 4 present the balance of the line for comparison. Next in order of importance to the man who drives is the provision for his comfort and convenience, and this is indicated in Fig. 2. As this view of the driver's compartment shows, the instruments are grouped conveniently in front of the driver on the instrument board, with the levers and pedals disposed in the more or less standard fashion on either side of the steering post, and at the driver's right, or convenient to his feet. The control includes friction retained spark and throttle levers on top of steering wheel, button type foot accelerator, pedals for clutch service brake and starter, levers for gear shifting and emergency brake.

To go over the bodies first, inasmuch as these show a greater number of changes than the mechanical construction, the roadster has been changed so that the widened rear of the body presents a comfortable seat for two besides the driver. There are two spacious compartments for luggage, one back of the seat and the other larger one beneath the rear deck. In the five passenger touring model the driving compartment and tonneau have been rearranged to provide more room, and the seats have been changed so as to afford the most comfortable position for driver and passengers. The upholstery at the sides of the seats is cut off rather squarely so that it gives almost arm rest appearaance and comfort.

The seven passenger touring has wider door openings, and more room than formerly for the extra passengers. All the open cars are equipped with a new top, which permits an unobstructed outlook to all occupants. The curtains swing with the doors. All closed cars are equipped with stormproof windshields with a new support for the upper and outer glass which alters the appearance somewhat, with anti-glare sunshade, and water tight doors. The changes in cowl and bonnet lines have been along the line of combining the two so that they present no line of demarkation, and appear as one with with a single slightly sloping straight line from radiator to windshield. This long line gives the impression of a longer engine space, and helps to make the car look longer and lower.

Taking up the mechanical part of the car, it will be best to describe this as a whole, without attempting to go through and present minor changes only. The chassis, as Fig. 5 shows, has a six cylinder water cooled engine at the front, back of the radiator, and driving through a multiple disc clutch to a three-speed transmission. Enclosed propeller shaft drives spiral bevel gears on the full floating rear axle. Semi-elliptic springs are used in front and cantilevers at the rear Both brakes are in the rear wheels, external contracting band and internal expanding band.

Taking up the motor first, this has 3⅜ bore and 4½ in. stroke, a ratio of 1 to 1.33 Cylinders are cast in a block, a single casting of semi-steel. Pistons are of cast iron and carry three compression rings near the top and

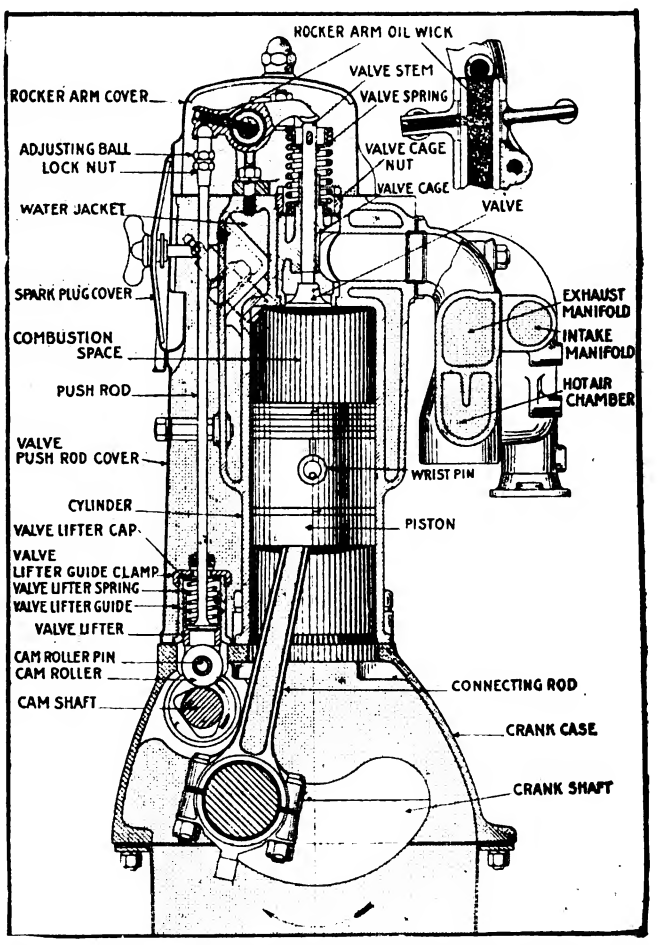


Fig. 3. Cross section through engine showing overhead valves, double spring valve motion and other features

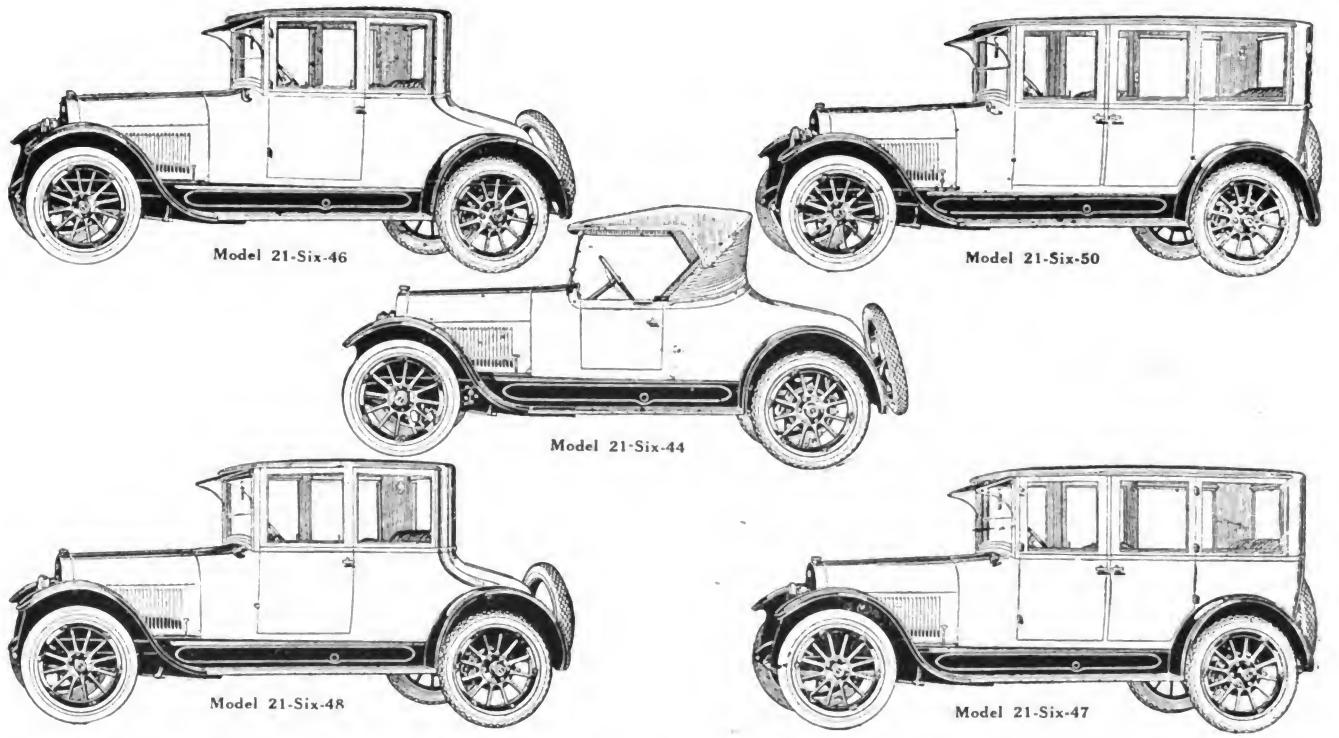


Fig. 4. Group of the 1921 Buick body forms, properly labeled, and showing the longer lower lines which characterize the 1921 product

one oil ring near the bottom. Connecting rods of the conventional H type are drop forged in the company's own forge shops of high grade steel. Extra heavy crankshaft has four bearings, those at front and rear being unusually long. Valves are mounted in removable cages set down in the cylinder heads, and are operated by noiseless adjustable self-oiling push rods. A section through the motor shown at Fig 3 will illustrate all these points and many more, notably the double spring operation of valve motion, one on the valve stem, the other on the lower end of the push rod. The latter holds the cam follower down onto the cam at all times and eliminates noise at high speeds.

The complete power unit, including clutch and transmission, is suspended at three points from the main frame, the two rear points being arms cast on the flywheel housing, which is an integral part of the crankcase. Although rating at but 27.3 h.p., the motor is said to develop in excess of 50 on the block.

Cooling is by water, circulated by centrifugal pump driven by spiral gears The radiator is of a new cellular type, with a new form of drain cock. The pump is located on the side of the cylinder between cylinders 2 and 3. Lubrication is by self-contained constant level circulating splash system. The gear pump is driven by spiral gears from the camshaft and is completely enclosed in the lower part of the crankcase. Pressure is indicated to the driver by gage on the instrument board, while an improved style of oil level gage on the crankcase helps in filling to get just the right amount.

Carburetion is by standard type of carburetor, located on the left side of the motor, and supplied with fuel from the rear tank by vacuum system. The intake manifold and exhaust header are so designed as to present an internal hot fin in the manifold which assists in vaporizing the heavier fuel of today. The carburetor may be regulated in part from the dash, where an air regulator is provided. Electric current for all purposes is supplied by a complete Delco single unit, built as an integral part of the motor and operating in conjunction with large storage battery. The ignition is of the high tension jump system current from the generator being supplied through an accessible distributor and timer. External wires are very short and pass through the spark plug cover, which covers the whole upper part of the right side of the engine, so as to be located almost entirely within the compartment. As in previous years, the spark plugs are set into the side of the cylinder near the upper part so that they actually enter the combustion chamber at the upper corner.

The clutch is of the multiple disc, dry type with four driving and five driven plates. All these are faced with asbestos fabric, so that the clutch is smooth in action and

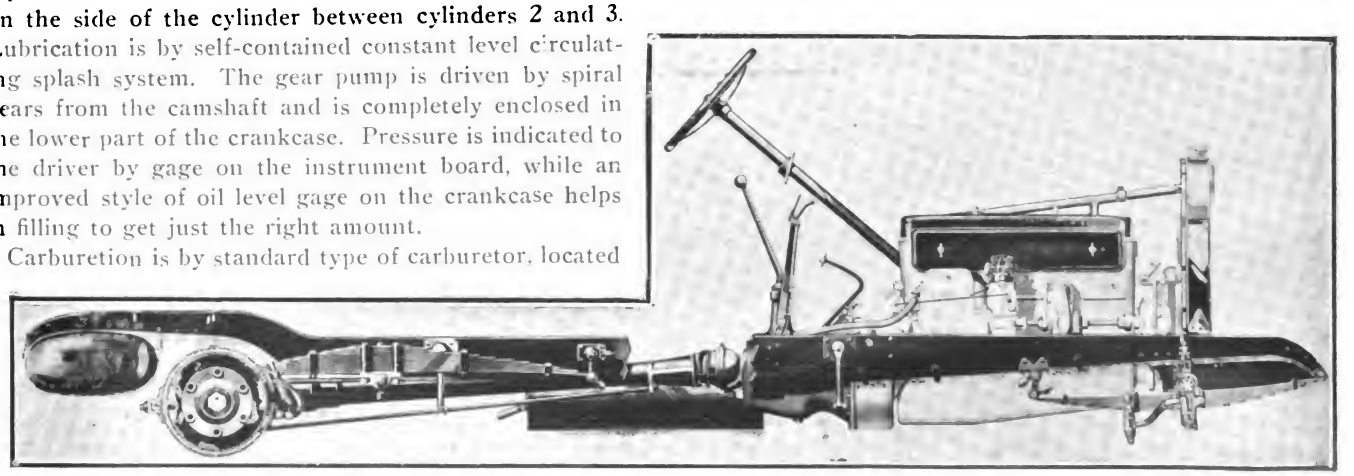


Fig. 5. Chassis sketch indicating disposition of various units, sturdy frame and adequate springing

positive. The release collar is mounted on a ball bearing, has an accessible adjustment, and is lubricated by two large grease cups located outside the case.

The transmission, rearmost part of the unit power plant, gives three speeds forward, and works on the selective plan. All gears are forgings, specially heat treated, and are mounted on short stiff shafts. The main shaft is on a pair of combination friction and thrust bearings, while the lay shaft, which is below, is mounted in plain bearings. The shifting mechanism is mounted on the gear case cover, and can be removed with it.

The rear end of the transmission carries, as a rearward extension, a spherical housing, within which the universal joint is located This full sphere forms on its inner surface a bearing and pivot for the driving shaft housing, a tube of large diameter which acts as the torsion member. As the center of the spherical joint and that of the universal joint in the shaft are identical, the housing and ball bearings An adjustment is provided to take up wear in the bevel gears, and a similar adjustment for the thrust bearing.

There are two sets of brakes, arranged concentrically on the rear wheel brake drums. The outer, contracting bands, are the service brakes and are operated by pedal. The inner, expanding type, are the emergency brakes and are worked by the hand lever. The brake drums are of large diameter pressed steel, and bolted to the wheel spokes. An inner member closes the inside of these drums so that no dirt, water, stones or other road material can get into the brakes Both forms are fully adjustable for wear, and this adjustment is so designed as to be easily reached and quickly operated.

Wheels are of the wood artillery type with 12 spokes all around. They have very large hub flanges and are equipped with demountable rims The tire sizes vary somewhat, all but the sedan on the shorter wheelbase

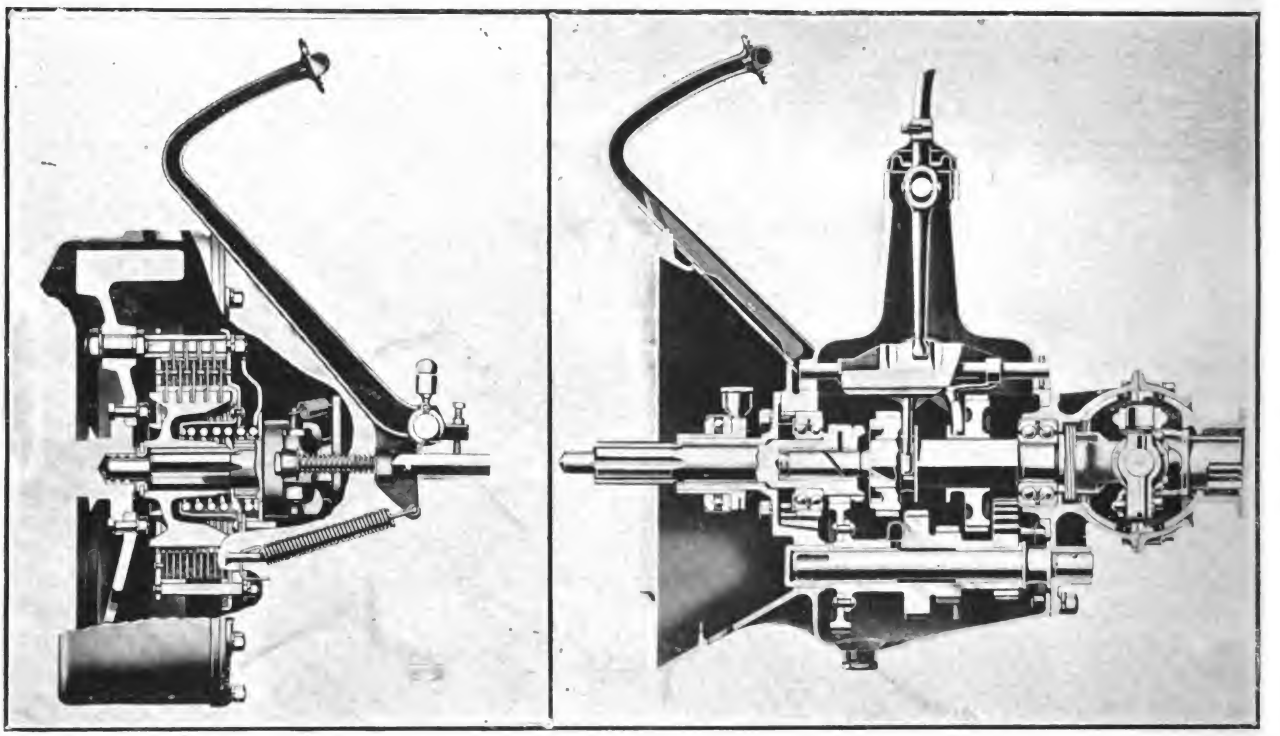


Fig. 6. Clutch (at left) showing fabric faced discs and enclosed spring. At right, transmission showing wide-faced gears and sturdy shafts

shaft act about the same point, in fact function as a single unit. This may be seen in both the chassis view, Fig. 5 and the transmission view, Fig. 6 at the right. From this point the drive is to the rear axle, which is of the full floating type. The actual drive is by spiral bevel gears. In this type of gear noiseless performance and efficient action are realized.

The full floating axle supports the weight of the car on the axle housing or tube, not upon the axle shaft. By carrying the weight upon the housing in this way, the shafts do nothing but carry the drive, which arrangement makes for safety and efficiency, safety in that the breaking of an axle shaft causes no danger to the passengers or car, efficiency in that each member has one special duty for which it is designed and built. Wheels are driven by detachable shafts mounted on large ball bearings of the annular type. Differential is mounted on taper roller bearings, and rear end of driving shaft on annular and thrust

job having 33 x 4 in. all around, while the five passenger sedan and all forms on the longer wheelbase job have 34 x 4½ in. all around. In all cases the fronts are straight side plain treads, while the rears have the all-weather tread.

The front axle has a drop forged I beam section, double heat-treated, with integral yokes (Elliott type), the center portion being perfectly straight as is the tie rod also. This gives a very pleasing front appearance which cannot be had with large bends or curves in the front axle and rod. Steering knuckles are drop forged, as are the tie rod yokes, both these and the axle proper being produced complete in the Buick shops.

Steering gear is of the semi-irreversible split nut and worm type with nut of bronze. A large ball bearing is provided to take the thrust, and this may be readily adjusted. The case is packed with lubricant and this is maintained by a large, convenient grease cup, easily

reached by raising the hood. The wheel is of large diameter, set at a very convenient angle for the driver's comfort, and carries spark and throttle finger levers, as well as central horn button.

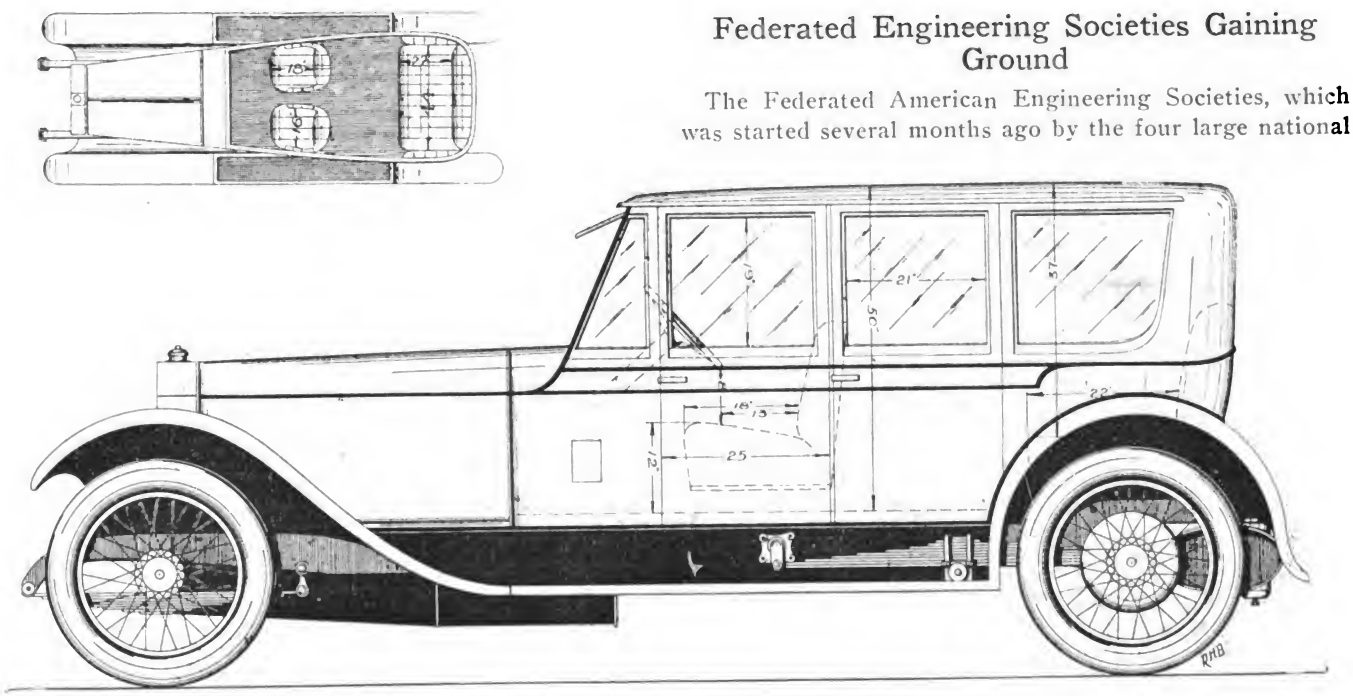
Frame is of reinforced pressed steel, channel section, with exceptionally stiff and deep side members. This will be noted in Fig. 5, in which the section is shown broken away at its deepest point just at the driver's position. There are four heavy cross members, one at the extreme front which acts as a radiator cradle, one at the extreme rear which acts as a fuel tank support, and two intermediates, placed beneath the driver's seat and midway between that point and the rear axle The engine has its forward point of support on the front cross member and needs no rear supporting member, as the two supporting arms at the rear rest directly upon the frame side members. In addition to its vertical taper, the upper flange of the frame tapers to give greater width just in front of the rear axle where the passenger weight is carried.

persons, the two front seats being of the divided arm-chair pattern while the rear seat is undivided full width. Both front and rear parts of the body afford unusual leg room, a point often neglected in smaller and shorter bodies, and one which brings much discomfort to tall people.

When all the windows are down, this body presents all the advantages of the open type body, with the added protection which the permanent top gives. The strikingly long fenders blend well with the other long lines of the body and are in pleasant relief to those commonly used, of doubtful utility and devoid of artistic effect.

Wire wheels of a special built up type add to the distinctive appearance, or if preferred, disc wheels which are rapidly coming into vogue, could replace them and would add further to the distinctive appearance.

Characteristics of the chassis: Wheelbase, 143½ in.; body space, 101¾ in.; tread, 56 in.; front seats are 16 in. wide by 18 in. deep; rear seat is 44 in. wide by 22 in. deep; both doors are 25 in. wide.



Five passenger enclosed drive limousine body, designed to be com modious and smart appearing

Federated Engineering Societies Gaining Ground

The Federated American Engineering Societies, which was started several months ago by the four large national societies representing the civil, mechanical, electrical and mining engineers, is obtaining substantial support, and is gaining ground very rapidly. It was started to bring about solidarity in the engineering and allied technical professions, and is to be an organization of societies, not individuals, This society of societies when completed by the adherence and support of all organizations would then become a super-organization representing the whole technical and engineering profession of the country.

The four major societies have appointed delegates to the first meeting of the American Engineering Council in Washington, D. C., Nov. 18-19, 1920. Other bodies that have voted to become charter members include: Kansas Engineering Society, Alabama Technical Council, Engineering Association of Nashville, American Institute of Chemical Engineers, Engineering Society of Buffalo, and the Society of Industrial Engineers. Before the meeting it is expected that more than a dozen additional societies and professional bodies will have decided to come in as charter members.

Ideal Car Serial—No. 12

Five Passenger Enclosed Drive Limousine

Specially designed for The Automotive Manufacturer by
RICHARD H. BURKE

This design of an enclosed drive limousine body has been prepared to be mounted on a Rolls-Royce chassis. Like many other standard styles of body work, the enclosed drive has undergone many alterations in its lines and methods of construction The design shown herewith is along the latest American lines, which presumably would differ somewhat from English, French or other designs of the same body for this well known chassis.

This body, which should interest the owner-driver requiring a comfortable and commodious car, is fitted with double doors on each side and larger quarter side lights in the back. The size of these lights, coupled with the big ones in the doors, and the unusual amount of glass in the front, makes an unusually well lighted body, and one from which it is possible to see clearly in every direction. The body gives ample seating accommodations for five

Paint As An Engineering Material

By E. J. SHEPPARD*

F we refer to the dictionaries in an attempt to define "paint" we find that all agree on one meaning—namely, "coloring matter for the face." The average description is "a substance used for painting." We next find that the word "paint," when used as a verb, is described as meaning "to cover with color"; color in its turn being described as a pigment or paint, which leaves us at the exact point at which we started. The American Society for Testing Materials has however adopted the following definition: "A mixture of pigment with vehicle intended to be spread in thin coats for decoration or protection or both." You will note that the definition gives greater prominence to the act of application and its purpose than to the material applied.

The use of decorative and protective coatings is of great and unknown antiquity. In biblical times Noah "pitched the ark within and without with pitch." Savages used pigments mixed with grease or fat for decorative purposes even up to recent times. At present there is nothing in domestic or outdoor life so common, so constantly before our eyes, as painted surfaces, yet outside the ranks of those directly interested, little attention is paid to the nature and composition of paint and of its proper and economical use. It seems that paint is often considered a luxury rather than a necessity; while paint improves the appearance of property, it is more valuable as a protection.

If paint is to exercise its function as a decorative or protective agent or both, it is obvious that it must have one quality, without which it will not protect very long nor decorate very satisfactorily. That quality is durability.

It is a general belief that paints are less durable than formerly, and in some instances this is probably true. It must be remembered however that where some paints last for a long time, many others have perished; it is essentially a case of survival of the fittest.

The durability of paint is influenced by four important factors:

1. The pigments used, their chemical composition and physical properties.
2. The vehicle.
3. The nature of the surface.
4. The application.

Let us now consider each of these factors individually. In selecting pigments there are three fundamental qualities to be looked for:

1. Opacity in an oil vehicle.
2. Fineness.
3. Paint making quality.

The opacity as defined by the American Society for Testing Materials is "the obstruction to the direct transmission of visible light afforded by a substance, comparison being made with sections of equal thickness." Many substances have little hiding power when mixed with a liquid, whereas in the dry state, where the particles are surrounded by air, they possess this property. In an oil vehicle the refractory index of the oil and pigment may be so close that the pigment has little hiding power.

The fineness as defined by the same society is the term used to denote the extent of subdivision and expressive of the number of particles of pigment in a unit volume exclusive of voids.

Finely ground pigments help to give a perfect paint, greater ease of application, and a finish to the job as well as greater spreading power. The best pigments are exceedingly fine powders and their physical characteristics are at least as important as their chemical composition, and in recent years the physical properties have been receiving the most attention. The pigment is the decorative part of the paint, that is the distinctive color desired is provided by the pigment.

On examining, for example, the white pigments, we find that only five fulfill the requirements of opacity in an oil vehicle—white lead, zinc oxide, basic lead sulphate, leaded zinc, and lithopone. The addition in small quantities of pigments deficient in hiding power may have no injurious effect, they may even be beneficial, but in larger amounts they should have the effect of cheapening the product. Now, cheapness is not an objection, except when it blinds or defrauds the purchaser. The chief so-called auxiliary pigments most commonly used, as asbestine, whiting, barytes, silex, china clay, etc., are more or less transparent when ground in oil; therefore for a white or tinted paint that really hides, some one of the five opaque pigments mentioned must be used. The auxiliary pigments alone are utterly without value and become in a degree respectable from their association with materials which are intrinsically valuable.

If the addition of these auxiliary pigments in small quantities to a paint made from an opaque pigment does not decrease the hiding power, then some explanation should be made as to the method by which this result was obtained. If it has been found, for example, that the addition of a small percentage of barytes to a white lead paint does not lower the hiding power of the latter, it must be due to the fact that less oil was used or that less surface was covered per gallon of paint than with the straight white lead paint.

Some people distinguish between "addition" and "substitution" of auxilary pigments to paints made with opaque pigments.

It is true that the addition of an auxiliary pigment does not decrease the hiding power of white lead, but the substitution does decrease the hiding power. If you make a paint of say, 4 gals. of oil and 100 lbs. of white lead, and another paint of 4 gals. of oil with barytes in place of some of the white lead, the hiding power of the latter will be less than that of the straight white lead paint. If however you take 2 gals. of paint, each containing the same amount of linseed oil and white lead and you add to one of these gallons a portion of dry barytes, the hiding power of the mixture will be greater than the straight white lead paint; what has been done then is the addition of pigment without increasing the oil. But the addition of dry

*Chief chemist, St. Louis Lead and Oil Co. Read before the Assoc. Eng. Socs. of St. Louis on June 9, 1920.

barytes necessitates the addition of more oil to make the paint suitable for application. You have therefore a substitution, not an addition.

Zinc oxide is perhaps as opaque as white lead, but it requires from one and one-half to two times as much oil to make a paint, hence the film has less pigment in it and it is generally allowed that it takes from three to four coats of it to equal two of white lead. An ordinary white lead paint contains at least a half more pigment by volume than an ordinary zinc oxide paint. It is therefore plain that a film of white lead will be much more opaque than one of zinc oxide, because there is so much more pigment in it.

White lead is one of the oldest manufactured pigments. It is mentioned by Xenophon, who wrote 400 B. C., and it was well known to many Roman writers about the beginning of the Christian era. Since that time it has become a well known article of commerce. We must therefore conclude that there must be some good reason for this supremacy of many centuries. A general utility white pigment equal or superior to white lead may some day be discovered and judging from the patent office reports of this and other countries, many attempts have been made to replace it, but without success. The reason for this seems to be that many of the substitutes do not possess the qualitites for which white lead is conspicuous; namely, opacity and durability.

As a pigment white lead possesses all the good qualities desired by a painter. It is distinguished from all other white pigments by the ease with which it mixes with oil and by forming a paint which flows readily from the brush and from which the brush marks disappear, leaving an even surface. White lead is the only white pigment which alone has been successfully used in conjunction with linseed oil.

Some years ago a theory was formulated in which a paint film was likened to concrete, and this theory has been responsible for the suggestion that the rigidity of a paint film might be increased if a pigment of various sized particles be prepared, so as to obtain what is known as a reinforced effect. In the last ten years many panel and fence tests have been made in an attempt to substantiate this theory, but no direct proof has been obtained. There is no doubt that there is some advantage in mixing products of various sizes but there is also no doubt that the reinforced effect is overdone by some of its exponents.

The ideal paint vehicle should have the following properties:

1. Freedom of working in the liquid condition.
2. Ability to change fairly rapidly on exposure to air to a durable film possessing the following characteristics:

A. Flexibility to enable it to follow the expansion and contraction of the painted surface without rupture.

B. Hardness to enable it to withstand mechanical injury.

C. Impermeability to moisture and gases, especially when used with pigments.

Linseed oil is practically the best commercial paint vehicle known today. It has ideal working qualities, but the very property which enables it to be used as a paint vehicle, that is, "to dry," is really the first stage of disintegration.

As I have stated before a paint is composed of pigment and a vehicle, and it is obvious that either alone will not protect. While the pigment alone does not change appreciably, the oil does change and the paint coating is finally destroyed. Sometimes one may hear that "the oil is the life of the paint," but even a superficial inspection of the paint tests made in recent years will effectually correct this idea. Dried oil is more or less porous and the pigment stops up these pores, thus making the coating more impermeable. It increases the hardness of the dried film, thus increasing its resistance to the wearing-away process caused by the elements, sand, etc.

The addition of volatile thinners to paint is largely for the purpose of thinning the paint to a better working consistency, that is, to reduce the labor of spreading the film in a sufficiently thin layer, and to assist the penetration of the oil and pigment into the wool. For these purposes they are valuable, but carried too far they cheapen the paint. Since they volatilize when the paint is spread, they thin the paint without increasing the proportion of oil in the dried film, thus making the film harder than if the vehicle were all oil.

The vehicle is the binding medium holding the particles of pigment together. On exposure the oil begins its various reactions of oxygen absorption and, as mentioned before, this is the first stage of disintegration. When hard, the reactions do not cease, and the oil decomposes slowly. The pigment thus loses its binder and the particles are gradually washed away. This results in what is generally called "the chalking" of paint and it is a progressive action which is more noticeable with certain pigments. The film remaining attached to the surface is continually getting thinner but is in an excellent condition for repainting.

The late Dr. Dudley of the Pennsylvania Railroad believed that the greater the proportion of pigment in the paint, the greater the durability owing to the fact that the pigment apparently protects the oil from decay.

The Surface

It is of the utmost importance that the surface to be painted should be in a fit condition to receive the paint.

Xenophon, some 400 years before the Christian era said "that a war horse, even if all his other points were fine, would yet be good for nothing if he had bad feet, for he could not use a single one of his fine points." It is exactly so with painting—if the foundation is poor, the subsequent work and material are thrown away.

To attempt to apply paint in damp, frosty or foggy weather on a greasy or dirty surface is a waste of time, material and thought. The presence of water, as in damp or unseasoned woods, is a frequent cause of trouble; the water evaporates in warm weather, either breaking the oil film, or throwing it off in the form of blisters.

The Application

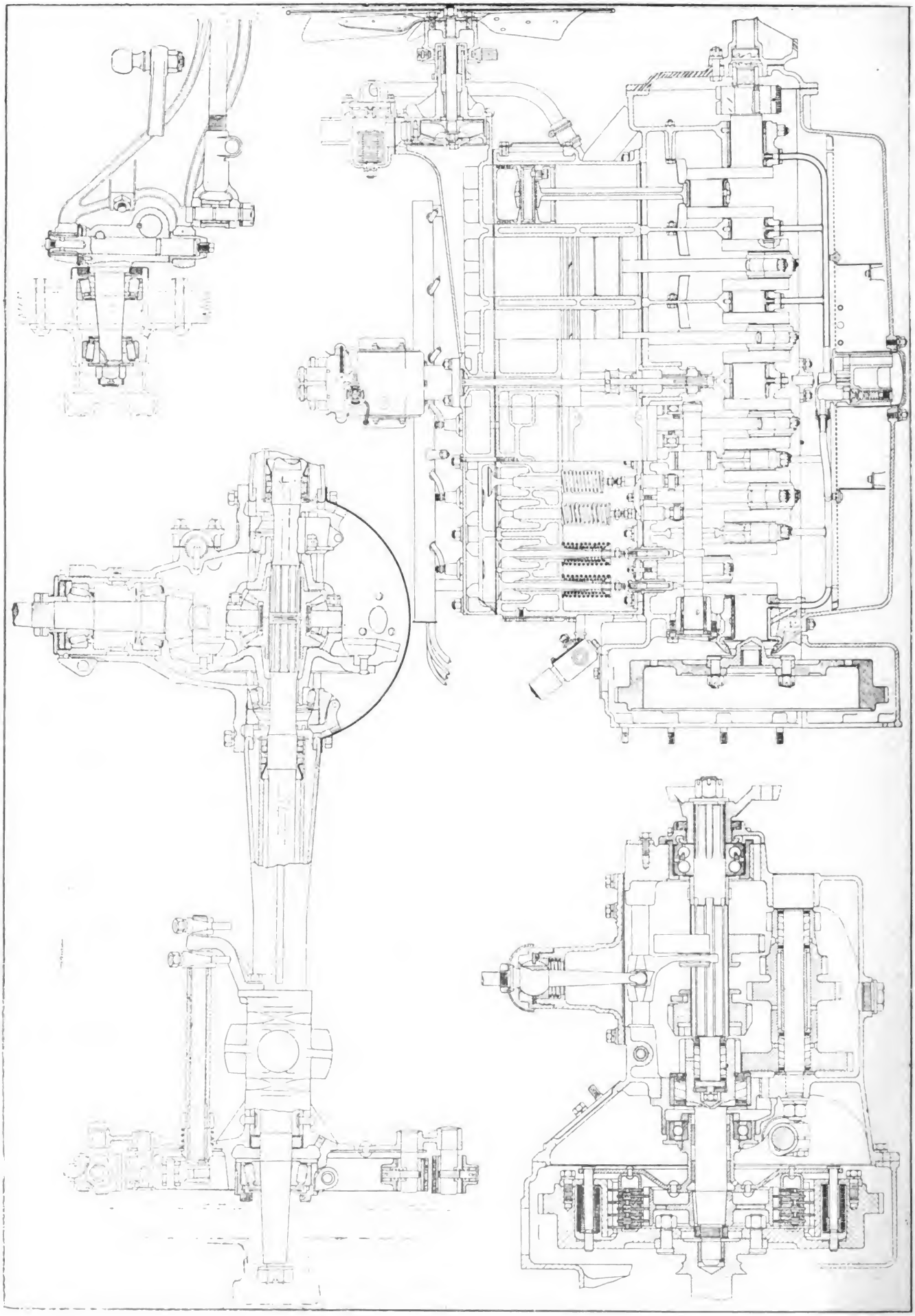
In the case of a defective job of painting, it is easier to blame paint materials than it is to blame workmanship. Marterials are tangible, workmanship is intangible. Every manufacturer of paint feels that if his paint were properly applied it would give perfect satisfaction.

Cost

Sooner or later the question of cost enters into all discussions of a practical nature. The cost of preserving structures by means of painting should cover:

1. The cost of materials per unit of area.
2. The cost of labor per unit of area.
3. Duration of effective service.
4. Cost of preparing surfaces for repainting.

(Continued in November number)



Most important units in the new Packard Single Six Motor Car. Fig. 1. (lower right) Longitudinal section through engine; Fig. 2. (lower left) Clutch and transmission drawing showing details of construction; Fig. 3. (upper right) Front axle end and steering knuckle; Fig. 4. (upper left) Part elevation, part section of rear axle showing pressed steel housing.

Packard Announces Single Six Smaller Model Car

Long-Expected Small Car From Big Detroit Plant Uncovered—Details Show Clean, Neat L-Head Six Rating at 27 H.P., 116-in. Wheelbase and No Remarkable Departures From Current Practice

ONE of the first of the new higher grade motor cars designed to present light weight, high gasoline and tire mileage with adequate power and substantial construction, is the newly announced Packard small car. The word small here is used in a relative sense, for the car has a wheelbase of 116 in. and is by no means a little machine. On the contrary, it has been designed for the utmost roominess compatible with the carrying of five passengers with maximum economy.

It should be stated at the outset that the Packard Company does not expect this new smaller model to replace the Twin Six; it is intended only to supplement it, to be a general purpose car of shorter wheelbase and lighter weight, and consequently having greater maneuverability in traffic. While it does resemble the Twin Six greatly in design as well as general appearance, in that a great many of the proven mechanical features are common to both and the same standards of workmanship are said to be set for both, there really is no possibility of confusing the two.

As has been stated the new Single Six is a five passenger job, and is offered in touring, runabout, coupe and sedan bodies. The touring car is priced at $3,640 at Detroit, the roadster at the same figure, the coupe at $4,835, the sedan at $4,950, and the chassis only at $3,000. What follows is largely mechanical description as illustrations of the body forms and descriptions of the same are not available as yet. When available, they will be presented to our readers.

In a general way, the car may be summed up as having block-cast six-cylinder motor rating at 27.34 h.p. and yielding 52 on test, dry disc clutch, three-speed transmission, wheelbase of 116 in., chassis weight of 2,250 lbs., and touring car weight, ready for the road, with gasoline, water and extra tire, of 3,080 lbs.

During the war the Packard Company did a great deal of war work especially in the construction of airplane engines of which it was one of the largest producers in the country, if not actually the largest. Considering this, and its possible influence upon all subsequent design and construction, it is interesting to consider the new power plant. This, shown in Figs. 1 and 5, is said to represent about two years of development work at the Packard factory. In fact this design is the culmination of experiments and trials which started immediately after the war and continued up to a recent date, when the final design was decided upon. It is an L-head unit with its six 3⅜ by 4½ in. cylinders cast in a block. Its S. A. E. rating is 27.34 h.p., and the brake horsepower, as developed on the Sprague dynamometer, averages about 39 at 1,600 r.p.m. and 52 at 2,400 r.p.m. which is below the peak point. The peak point on the horsepower curve is about 2,750 r.p.m. The breake mean effective pressure is around 83 lb. per sq. in. at 800 r.p.m., and above 80 lb. from 500 to 1,600 r.p.m. The compression ratio is 21 per cent. The engine structure is built up of four principal components, these being the cylinder block and cylinder head, which are both of cast iron, and the crankcase and oil pan, which are both of cast aluminum. This division of the structure into four castings permits of the simplest possible casting and hence permits of core work giving the maximum water jacketing space, and at the same time, minimum weight.

The pistons are also cast iron, and weigh 1 lb. 7 oz. each. They are 3⅜ in. in length and fitted with three rings all above the piston pin. These rings are 3/16 in. wide by 7/64 in. thick. The piston is therefore a square type with the same diameter as length. The piston pin is slightly below the center of the piston and the piston pin boss provides sufficient stiffness without additional ribbing in the piston. The piston pin is of seamless steel tubing, anchored in the boss by means of a screw through the bottom of the boss.

Valves are interchangeable, of the usual 45 deg. type, being 1½ in. dia. in the clear, with a lift of 11/32 in. The order of firing is 1-5-3-6-2-4. Valves are so timed that inlets open 9 deg. past upper dead center and close 42 deg. past lower dead center. Exhausts open at 47 deg. before lower dead center and close 4 deg. past upper dead center. As will be noted this gives an interval between exhaust closing and inlet opening of but 5 deg. Valves are closed by double concentric springs, and are accessible for adjustment by the removal of a cover plate held in position by thumb nuts.

Connecting rod is a drop-forged I-beam section machined all over. It is 9¾ in. center to center, bushed at the upper end for the piston pin bearing and split at the lower end for crankshaft bearing. The former bearing is ¾ in. in dia. and 1½ in. in length, and the latter 1¾ in. in dia. and 1½ in. long. The shaft has seven bearings for rigidity, all of 1¾ in. dia. Lengths from front to rear are: Front 2 9/16 in. center, 1 57/64 in.; rear 2½ in.; four intermediates, each 1 9/64 in. These figures give an aggregate bearing length of 10 33/64 in. and a projected bearing area of 18.503 sq. in. It is of the oval cheek type, and all bearings and pins are ground to size. Both connecting rods and crankshaft are of 40 point carbon steel.

Timing drive is by silent chain, this being 1 7/16 in. wide, in a triangular layout to operate camshaft and generator shaft sprockets. The camshaft is 1 in. in dia. with cams integral mounted in four bearings, which are 27/16, 1, 1 and 1¾ in. in length from front to rear. Valves are operated by a lifter finger pivoted at one end and operating the tappets at the other by a hardened and ground button forming the end of the finger and contracting with the bottom of the hollow tappet. The lifter finger carries a roller follower slightly nearer the tappet end upon which the cam acts. This lifter finger is pivoted on a rocker shaft accessibly mounted in the removable side of the crankcase. These rocker shaft assemblies may be removed in groups of six by removing the stud nuts holding them to the crankcase. Springs prevent side sway and noise by

forcing the arms against proper surfaces. The finger type of valve operation has the advantages of greater ability to follow the cams at the higher speeds and removal of thrusts. It will be recalled that the engine shows its power at relatively high speeds, giving 39 at 1,600 and 52 at 2,400 r.p.m., so this feature is of double importance.

Lubrication of the motor is by full pressure system, the oil pump in the center of the aluminum oil pan being driven by the same vertical shaft that drives the ignition distributor at its upper end. This is in the center of the length of the engine, between cylinders 3 and 4. The pump can be removed from beneath, without dropping the oil pan, by removing the nuts from the studs holding the cap in place, this as Figs. 1 and 5 show being on the outside of the oil pan. The pump is of the gear type and

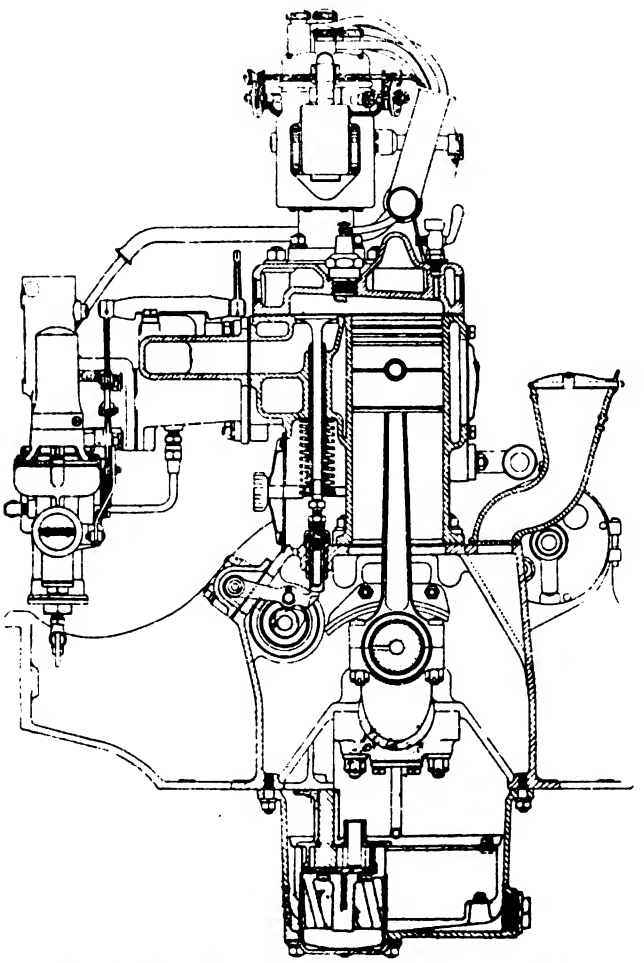


Fig. 5. Cross section of Packard Single Six Engine

at 1,000 r.p.m. delivers 25 lb. per sq. in. pressure. After passing through bearings and lubricating other parts, the oil returns to the crankcase where it is drained through a screen in the oil pan, and is again screened before it enters the pump. Baffle plates in the oil pan, placed transversely, prevent surging of the oil.

Carburetion is similar to that on the Twin Six, the vaporizer being the same. This is fed from a 19-gal. tank at the rear of the frame, with Stewart vacuum system of feeding. The fuelizer, so called, is used on the smaller model also. This consists of a heating chamber through which some of the combustible charge is by-passed and in which it is ignited by a special spark plug. By the use of up-to-date methods in manifolding it has been possible to closely approach airplane figures in fuel economy tests. With full load at wide open throttle, the best point on the economy curve is 0.57 lb. of fuel per b.h.p.hr. which approximates results obtained in aviation practice. A little kink in manifold design, which was learned in building sixes, consists in the use of a split lead; that is, there is a partition in that branch of the intake manifold which extends down toward the carburetor, which breaks the stream into two parts for the fore and aft groups of three cylinders. It has been found by Packard engineers that loading exists in the plain T form of construction in the intake manifold of a six, due to the surging which takes place. By means of this split distribution the surge is eliminated and no loading troubles are experienced.

Ignition is by Delco system, and starting and lighting by Atwater-Kent, with Bendix pinion shift. The ignition distributor is driven from the top of the same vertical shaft as drives the oil pump, and is located on the top of the engine slightly to one side, between cylinders 3 and 4, as mentioned previously and shown in Figs. 1 and 5. The Atwater-Kent starting motor is separate from the generator, the motor being held by standard type S. A. E. flange to the flywheel housing on the crankcase. Generator is on the right side of the engine, driven by timing chain. It is secured to crankcase by boss on the timing gear housing at front end.

Cooling is by water, circulated by centrifugal pump. The system has a capacity of 4 gals. and the temperature is controlled by a thermostat which is set at 120 to 150 deg. F. An unique feature of this design is that the thermostat construction is an integral part of the water outlet header, being built into a slight projection on top of the front end, as Fig. 1 plainly shows. The arrangement is such that the water is bypassed back to the jackets and does not circulate through the radiator until it reaches the temperature at which the thermostat is set to open. One desirable effect of this is to warm the engine up quickly, as on starting when the water is cold it does not circulate to the radiator but simply surges around within the jackets and header until it becomes hot enough to open the thermostat, that is above 120 deg. It is of the direct acting type.

Another unusual feature of the design is that the water pump and fan are practically one unit, being driven by a V-type of belt from the same shaft. To bring about this result, which eliminates many parts the pump has had to be lifted from the usual position alongside the crankcase, which is below the lower level of the water jackets so the water flows to it by gravity, to a position above the tops of the cylinders so the water must be lifted by suction. While this position increases its accessibility on the one hand and while its exact location make little or no difference to the motorist so long as it circulates the water satisfactorily on the other, it does represent a departure from conventional design.

In this high position, this unit combines the functions of the pump shaft and fan shaft, gives a balanced construction, and calls for but one packing gland, which is in an accessible position behind the fan. The radiator is a hexagon type with extra large tank at the top. This precludes the possibility of the water level dropping so low that the pump will not feed, and by providing larger water capacity makes for more certain and more efficient cooling. One advantage of this high location is that the generator is made more accessible, the removal of the

pump from the usual position giving more room for this and other accessory units. The arrangement provides also for a swinging adjustment of the generator to take care of the silent chain drive slackness if any.

Before leaving the discussion of this interesting power-plant, it may be mentioned that it belongs neither to the high speed nor the low speed class. It is also of great interest to compare this with the Packard 1-38 of 1912, which had about twice the displacement of the present model, and yet it developed only the same horsepower. Of course this engine operates at 2,400 as compared with 1,800 for the 1912 model, but as a result of better design a higher mean effective pressure is secured. Another way of looking at it is that for the same horsepower the weight of the engine has been cut in two.

The clutch, shown in section in Fig. 2, is a dry plate type with seven plates, four driving and three driven. The plate diameter is 8 in. and the whole unit is housed within the flywheel in the conventional manner. As will be noted in the drawing, each disc is faced on one side with asbestos facing. Springs are of the small-diameter coil type, and are entirely enclosed within the flywheel covering plate. While the transmission which is a unit with clutch and engine, is mounted on Hyatt roller bearings, a ball thrust bearing is provided at the rear end of the clutch with threaded collar means of adjustment.

The gear set provides three speeds forward, the gearbox ratio being 3.368 to 1 on first (low), 1.774 to 1 on second, direct on third (high), and 4.26 to 1 on reverse. Clutch and gearset have been designed together to give a very smooth shift and to facilitate this, the rotating mass in the clutch has been cut to the minimum, so that when the clutch is disengaged the only units in motion are the very light sheet steel discs. The shifting gears have an unusually short travel, as the drawing Fig. 2 shows, and are chamfered for easy engagement. Gears also have unusually wide faces. Main shaft is short and of large diameter, with gears mounted on splines which extend the entire working length. The whole transmission is very compact, the distance between main bearings being quite short. This makes an exceptionally sturdy unit, and one which should be very quiet in operation. Besides the roller bearings mentioned, the rear end of the main shaft is mounted on a combination load and thrust bearing of the double row ball type. Shifter mechanism is mounted on the cover plate and removes with it. Drive is through hollow propeller shaft with two universal joints of the fabric disc type. The shaft has an outside diameter of 1¾ in. and an inside diameter of 1 39/64 in., making the shaft walls only slightly over 1/16 in. in thickness, 0.0703 in. to be exact. This is probably the type of extremely thin-walled but very strong and flexible drive shaft described in Automotive Manufacturer for April, on pages 21, 22 and 23. It will be recalled that these advantages were mentioned at that time. Lack of lubrication needed, extreme quiet, lighter weight with greater strength, easier riding and longer life, shock absorber action which saves drive shafts and units at either end, saving in repair bills and replacements, greater all round economy.

Drive is taken through the springs, and torque through a torque arm, pivoted to the differential housing at the rear end, and to the frame cross member directly beneath the driver's seat at the front end. The rear axle, shown in partial section in Fig. 4, is of the semi-floating type, with taper roller bearings at all points. The axle gear ratio is 4.31 to 1. The brake drums are on the rear wheels and have an expanding brake working on the inner, and a contracting band working on the outer surface. Diameter is 14⅜ in. and width of face 2¾ in. Semi-elliptic springs are used both front and rear, the fronts being 38 x 2, and the rears 54 x 2¼ in. Wheels carry 33 x 4½ in. tires all around. The frame is a 7 in. channel of the straightline, tapered type, that is of a straight taper from the spring horns at the front to the rear spring attachments. A torsion tube cross member is used at front and rear ends, other cross members being of channel section. This taper construction gives a very narrow front, which in combination with the short wheelbase, produces an unusually short turning radius, it being possible to turn the car in a circle of 16 ft. 8 in. radius. Steering is by an opposed threaded worm and split nut mechanism with plain bearings.

Materials have been chosen throughout to facilitate the idea of light weight, high quality and modest price. Thus the crankcase is of aluminum alloy, transmission gears of chrome-nickel steel, propeller shaft and front axle 40 point carbon steel, axle shaft of chrome-vanadium steel, and axle gears of chrome-nickel steel, axle housing steel stamping, and frame of 20 point carbon steel.

As a result of its light weight, good balance, unusual fuel vaporizing ability and other built-in qualities, the company claims that it is very economical of fuel and tires, 20 miles per gallon having been obtained in testing it out, while some tires on experimental models were in fair condition after 25,000 miles of service. From this it is argued that the average driver should obtain at least 15,000 miles in average mixed city and country driving. Further driving advantages to which attention is called are ease of steering and very short turning radius, light clutch action and smooth gear shifting. With all these desirable qualities, the new car should achieve deserved popularity in a short time.

Overheating Reduces Strength of Glue

That long continued heating reduces the strength of animal glue solutions is demonstrated by the following test made at the Forest Products Laboratory.

Solutions of a high grade joint glue and a veneer grade glue were heated for 48 hours at 104, 140 and 176 deg. F. and tested every few hours during this period for strength and viscosity.

In the first seven hours of heating at 176 degrees the veneer glue lost approximately one-half its joint strength, and the high grade glue joints weakened almost as much. The greatest loss in the strength of the glue joints occurred at this temperature. In the solutions kept at 104 degrees there was a sudden drop in the strength of the joints made with the high grade glue after 31 hours of heating, due possibly to a combination of bacterial and chemical action. The veneer glue joints showed a more gradual decrease at this temperature. The most favorable of the three temperatures tried was 140 degrees, but even at this temperature an appreciable weakening in both glues was noted at the end of 7 hours, and longer heating caused greater loss.

The viscosity of the high grade glue declined more rapidly than that of the veneer glue, but at the end of the heating test the viscosity of the high grade glue still averaged higher than that of the veneer glue.

Alcohol as a Possible Remedy for Fuel Shortage

Exact Statement of Present Fuel Conditions—Possibilities in the Way of Mixed Fuels, and Large Part Which Alcohol May Play in Mixtures

WITH reference to the present situation, it will be sufficient to state that all rosy statements to the contrary, there is a marked and growing shortage of crude oil, and consequently of the components needed for automotive vehicles. The official report covering the month of August, the latest complete report available, shows that despite the largest monthly production on record, totaling 39,144,000 bbls., which is at the rate of 470,000,000 bbls. a year, the shortage for that month alone, that is the difference between production and consumption, was 8,670,000 bbls. In July, which had the second largest production for the year, the output was nearly as large, 38,548,000 bbls., but at that the month indicated a shortage of 5,864,000 bbls. In June the story was the same and the shortage almost as great so that the total shortage for the last three months was 19,924,000 bbls. or in round figures twenty million barrels. At this rate the depleted storage stocks would soon be used up, were it not for the fact that imports from Mexico have also assumed record proportions. Whereas a few years ago, a Mexican output of sixty to seventy million was considered a sthat country's maximum, in July the total excess of imports over exports was 6,066,570, and in August 10,257,748 bbls. The latter is at the rate of 123,000,000 bbls. a year.

Against this situation, which shows that the lighter American oils are only meeting the situation through the tremendous imports of the heavier Mexican crudes, and the two combined are showing an actual shortage, with no other fields available to help out the situation, it must be admitted that the actual automotive fuel demand has been met by the production of a growing quantity of synthetic gasoline through the more or less widespread adoption of cracking production. In many cases, these have doubled the output of motor fuel from a given quantity of crude oil.

There are in use in this country today in excess of 8,000,000 automotive vehicles, and these are being added to at the rate of 200,000 a month, 8,000 per working day. Despite increased economy and the much greater number of smaller more economical cars, the average amount of fuel needed per year is kept up to the 400 gallon mark by the relatively greater proportion of trucks and tractors. On this basis, the number in use today requires 3,200,000,000 gals. per year, while the new vehicles add to this at the rate of 80,000,000,000 gals. per month, 3,200,000 gals. per working day. Pennsylvania and Ohio crudes will yield in excess of 33 per cent by cracking methods, but these oils form but 3 per cent of the total. The big bulk consists of Texas, California, Oklahoma and Mexican crudes, which are heavier. California and Mexican oils are of an asphalt base, and even under cracking processes yield less than 11 per cent on the average. Texas and Oklahoma oils yield about midway between the two, or from 16 to 18 per cent. Using these figures as a basis, present maximum production totals and maximum possible yield of motor fuel using all the crude oil, would yield but 3,000,000,000 to 4,000,000,000 gals. This is a maximum condition however. Based on the present consumption, and rates of increase, the amount needed will be 3,600,000,000 gals. a year by Jan. 1, 4,000,000,000 on June 1, and 4,400,000,000 Nov. 1 of next year. These figures show how narrow a margin we are working on, all this too, being upon the basis of using all the crude oil in cracking processes which is far from the actual case.

In this dilemma what other fuel sources are there? It was suggested by Joseph E. Pogue, Sinclair Refining Co. expert, formerly with the Bureau of Mines, Fuel Division, that aside from present crude petroleum including shale oil, there are two possible sources of motor fuel, namely, benzol from by-product distillation of coal, and the alcohols and ethers from organic substances. With reference to the benzol production, coke ovens produce less than 50,000,000 gal. a year, and artificial gas plants about 5,000,000, so that even with great and rapid increases in this field, only about 100,000,000 gal. a year can be counted on for some time to come. It is estimated that only one-twelfth of the coal consumed in the country is worked in by-product plants. Consequently, even if all the coal were consumed in such a way as to save all by-products, the output would be but twelve times the present figures, or in round figures less than 700,000,000 gal. a year.

From this point of view then alcohol offers the biggest future. Aside from providing a profitable work from the large number of breweries and distilleries of the country, the production of alcohol through fermentation processes might easily become a by-product of considerable profit, to the many food products plants and canneries.

The fermentation industry, notably the branch having to do with the manufacture of industrial alcohol, has been strongly stimulated by war demands, and industrial machinery is now available for the production of considerable alcohol for fuel purposes. The arrival of prohibition has also freed a large equipment from other duties, which might in part be devoted to a similar end. There are serious handicaps of a sentimental nature however which tend to bind the manufacture of industrial alcohol with governmental restriction harmful to proper progress; although the war-installed equipment and the cheapness of the requisite raw material may be sufficient to balance these drawbacks.

Alcohol alone can be used to advantage only in engines especially adapted to this fuel, but various mixtures of alcohol, benzol, gasoline or other petroleum distillates and other materials have given promising results. It is of great significance from an economic standpoint that alcohol, benzol and the lighter petroleum distillates such as gasoline and kerosene can readily be rendered miscible. It is probable that alcohol, like benzol, will not come into widespread use as a single fuel, but has a broad significance, for the present at least, only as a blending agent in connection with liquid fuels obtainable in larger quantities.

The quantity of alcohol which will be produced in this country in the immediate future is much more difficult to

forecast than in the case of benzol. The United States in 1916, 1917 and 1918 turned out about 50,000,000 gal. of denatured alcohol each year, having jumped from an output of 14,000,000 gal. in 1915 under the stimulus of a demand born of munitions requirements. Much of the industrial alcohol under manufacture today is made from sugar molasses and waste sulphite liquor; while garbage, fruit wastes and ethylene from coal distillation plants have been suggested as supplementary resources. While the alcohol capacity of the country cannot be closely estimated without a special investigation beyond the scope of this article, the conclusion seems inevitable that for some time to come the available supply of alcohol will bear a close quantitative analogy to benzol, the two combined bulking small when compared with engine-fuel requirements which will approach 5,000,000,000 gal. late in 1921.

On the whole therefore it may be concluded that benzol and alcohol hold somewhat analogous positions in respect to the supply of engine fuel. Neither can be produced in sufficient quantities in the near future to replace gasoline; both have interesting possibilities in the direction of improving the character of the fuel supply in respect to present engine types. This whole field is undeveloped and stands in need of more research attention than has been accorded it.

Composite fuels, while holding out the possibility of improving the adjustment now obtaining between the fuel and the engine, present also the danger of obscuring for a time the necessity of adaptations on the part of the engine in the direction of higher thermal efficiency and lessened dependence upon specialized fuels. Composite fuels, if found to fulfill their initial promise of advantage in utilization, can be developed by the oil industry or, in a more limited manner, by outside agencies; but they can be more readily developed on a larger scale by the oil industry, because of its control of working channels of distribution.

While nothing revolutionary may be expected in the way of composite fuels that will displace gasoline in the next year or two, there may come into evidence a steady trend toward a fuel supply of petroleum origin carrying quantities of other materials, chiefly benzol and alcohol, which will facilitate utilization in the present types of engines. It would be unfortunate however if this outcome resulted in a relaxation of the efforts for higher thermal efficiency and for lessened dependence upon specialized fuels, which still remain essential elements in a fundamental solution of the engine-fuel problem.

The above represents largely the opinion of Mr. Pogue, who is essentially an oil man, in that he views the situation from a mineral oil standpoint, hence it is not strange that he leans strongly to that side, and makes plain the point that for years our main dependence will have to be upon mineral oils, and that the shortage of such basic commodities will keep the price high. But is this actually the case? Let us see if it is not a fact that our molasses, corn, acetylene and other potential sources of large quantities of fuel alcohol will bulk up so large as almost to make mineral oil secondary, and in the second place, to insure adequate fuels for continued automotive expansion. With the tremendous investments in automotive vehicle manufacturing plants, to say nothing of the equally large investments in parts, accessory and material plants, the latter is almost as important as the former.

Hitherto most of our so-called industrial alcohol has been obtained from sugar mill waste, i.e., the well known blackstrap molasses. The amount of this basic raw product is decreasing, mainly because the refiners have brought into play processes which make it possible for them to secure from the molasses various marketable syrups to satisfy the popular sweet tooth. True, low grade molasses can still be had from the sugar mills of the Far East and other remote sources, but this entails the service of special tank steamers and the added costs of transportation. How then are we to produce the great measure of alcohol which we shall want ere long?

In Germany nearly 70 per cent of the annual output of more than 100,000,000 gals. of alcohol is got from potatoes. In France, on the other hand, the chief source of industrial alcohol has been the molasses from the beet sugar refineries. Both of these basic raw materials are to be had in the United States in abundance, especially potatoes of the kind known to the farmer as seconds and culls, for which there is only a limited market. Potatoes that are unfit for food, because diseased or touched by frost, can be utilized in the manufacture of alcohol. A ton of the tubers, if they contain 16 per cent of starch, will yield 25 gals. of alcohol. Many millions of tons of potatoes are sacrificed yearly which could thus be profitably consumed in the distillation of motive spirits.

But probably the most promising native source of industrial alcohol is our vast corn belt; maize for years has stood pre-eminently as the cheapest raw stuff for the distillers. It is easy to raise and stands transportation and storage admirably. It is undeniably true that wood waste is susceptible of furnishing a great volume of industrial alcohol, but there are difficulties of an outstanding nature which now seriously hamper putting any of the processes in service upon a commercial scale of moment. Similarly, recent developments in the field of chemistry have shown that it is entirely practicable to get a goodly measure of alcohol from the waste liquor of the mills engaged in the making of sulphite paper stock. The Germans are said to obtain quite 3,000,000 gals. of spirits from this origin annually; and the Swedes are employing a kindred method of their sulphite mills—10,500,000 gals. of 100 per cent pure alcohol are thus realized in the course of a twelvemonth.

But alcohol in quantity enough for industrial and motive purposes is not to be had from by-product materials. We shall have to count upon an ample primary substance which can be cultivated for that purpose season after season. Here is where corn meets every requirement. It can be planted and harvested within ninety days throughout an enormous area; and a ton of the grain should yield about 89¼ gals. of pure alcohol. A large distillery should be able to handle 10,000 bushels of corn a day, and do this 300 days a year. That is to say a plant of this size would have an annual output of 7,500,000 gals.

In 1919 we grew 2,900,000,000 bushels of corn, representing a possible source of 7,250,000,000 gals. of alcohol. As a matter of fact, during the past year, our gasoline consumption amounted substantially to 3,100,000,000 gals. Manifestly then if one-fourth of our corn had gone to the distillers of industrial alcohol we should have been in a position to get enough motive spirits to cut down the use of gasoline by fully 58.4 per cent. And if alcohol were

used as the basis of a synthetic fuel such as those already mentioned, the mixture with ether, toluol and benzol would effect a gasoline economy of quite 70 per cent in one case and 100 per cent that with ether alone.

The 1920 corn crop estimate of 3,100,000,000 bushels would yield 7,750,000,000 gals. on the same basis, so that one-fifth of it used for alcohol would supply almost half our present fuel needs.

The point to be kept in mind is that our farmers have it within their power tremendously to amplify the acreage planted in corn; and it has been suggested by the agricultural authorities that it would be possible to secure a still greater yield of alcohol if cornstalks were utilized. But this theoretical source of more motor spirits need not be considered because there are practical difficulties that stand in the way of putting laboratory revelations along this line to commercial use. Success in the manufacture of industrial alcohol rests fundamentally upon a sufficient and a continuous supply of the primary raw material, and because of its keeping qualities, corn can be harvested and then held in storage where it can be drawn upon months thereafter. In this respect it is unlike a number of other potential vegetable sources of alcohol which can be turned to account for this purpose only during a comparatively short season.

Without going into the details of the making of alcohol from farm products, it will suffice to say that the first object is to convert the starchy content of potatoes, corn, etc., into sugar through the agency of fermentation; and as a further result of the action of the yeast the sugar is split up into alcohol and carbonic acid gas. Subsequent continued distillation separates the alcohol from the water with which it is combined, adding step by step to the strength or purity of the spirits.

According to present practice, little if any of the carbonic acid gas is saved from the fermenting mash, and right here exists a means of greatly lessening the cost of alcohol. A bushel of grain during treatment will give off seven pounds of CO_2. This gas has a ready market in the charging of bottled waters, beverages, etc., and for use at soda fountains. In fact the present demand is far in excess of the supply. The CO_2 liberated during fermentation is in its purest state and is superior to that made from marble dust, which has to be very carefully filtered, etc., to render it salable. Carbonic acid gas figures in refrigerating systems, and its fields of application are wide and varied. With a proper installation there is apparently no reason why this money-making by-product of the distilleries should not be conserved.

Lest there be a mistaken notion that a foodstuff as such is lost in the manufacture of alcohol from corn, it should be kept in mind that there is a fibrous residue or "slop" which contains 12 per cent of fatty matter and 33 per cent of protein. This, when dried in drums, looks not unlike middlings, and constitutes an excellent feed for hogs, cattle and chickens. The thin slop may however be fed to livestock by mixing it with roughage or by adding a proportion of the "middlings." This brings us to the story of a new fuel which is rapidly growing in favor and finding many serviceable applications.

(To be continued)

Many and Varied Price Reductions Disturb Industry

WHEN Henry Ford on Sept. 21 announced his now famous reduction prices, in the language of the street, "he started something" and that something is still distrubing the industry, and bids fair to continue doing so up to the completion of the 1921 announcements the latter part of the year, or if these are delayed until show time, until well into January of next year. As a general proposition, the industry is now divided sharply along two lines, those who side with Ford and admit that the people want and must have a reduction in prices and must have it now, whether justified by present material and labor costs or not, and those who side with Durant and General Motors group and claim that they have always worked on a fair margin and that at present costs and profits no reductions are justified, in short that right now reductions in prices are economically unsound.

Everyone admits that material prices are high, yet it is only fair to say that if all manufacturers take their stand on the basis of present conditions and refuse to make any concessions, there never would be any change in the situation. It would seem as though the contention of those now reducing prices that as a result of such reductions they will be able to force lower prices on materials, and thus complete the cycle, is sound and based on good common sense.

Moreover the facts bear out their contention To date 29 car makers have reduced prices, while 5 have increased them; 13 truck makers have made cuts, and 1 has added the war tax, in effect, an increase; 3 tractor makers have made reductions, so the total of makers reducing is 45 against 6 making increases. Figures which are available for 22 of the car makers indicate that the average increase in the 4 years from Oct. 1, 1916, to Oct. 1, 1920, is $1,119. Based on the 1916 selling price which averaged $1,605, this amounts to slightly more than 69 per cent. And the Oct. 1920 price includes the recent reductions, that is with the reductions taken out, present prices show an increase of over 69 per cent in the last 4 years or about 17¼ each year. Even if the higher priced machines be eliminated the showing is less in dollars but greater in percentage, 20 cars which averaged $1,280 in 1916, now with the reduction taken out have an average increase of $908, which is 71 per cent for the 4 years or 17¾ per cent per year. A similar computation made in Detroit covers 17 prominent makes, and shows that from Aug. 12, 1918, to Aug. 12, 1920, these makes increased on the average $399 or 28½ per cent. That is, before the present price cutting began these 17 makes had been increased nearly 15 per cent each year.

Of course materials have gone up and still are very high, but a few of them have begun to come down, in fact some were down before the price reductions commenced. Labor too, is still very high, but with lessened demand for goods and some unemployment, that situation is expected to right itself slowly, from a beginning already made. That material prices alone are not the deciding factors

may be realized from the simple statement that rubber is lower than it has been for years and cotton too is down to remarkably low levels, so low in fact that planters claim they take a loss when they sell; copper is lower than at any time in the last 5 years, zinc and lead are down to very low figures, aluminum is practically at a pre-war figure and that too, for a better and stronger metal than was available 6 years ago, yet many machines of which these materials form a large part are practically not reduced at all as compared with 6 months ago. All the materials entering into tires and tubes are down from 50 to 80 per cent as compared with a year ago (as for instance rubber at 28 cents compared with $1.05), yet tire prices have been reduced about 17-18 per cent on the average.

In many instances, the price reductions have brought about much immediate business, which was latent and simply required a good sized cut in prices and the attending publicity, to bring it out The forthcoming months will have a large influence in determining how the new year and its business are to shape up; if the price situation is handled carefully, there is still an enormous unsatisfied demand, and with prices at the right level, that is the level which seems right to the buying public, 1921 can easily become the best year the industry has ever known. With overlong adherence to high prices on the part of those manufacturers who claim price reduction now is economically unsound, the unsettled situation may be continued, the public may hold off from buying, and the coming year's business may be very much reduced. A united industry at low price levels and a large volume of business is much to be preferred to a disorganized industry with widely varying prices and spotty uncertain small volume business. Now that the movement has been started and has received the sanction of as many as 45 reputable manufacturers, it would seem that public opinion will shortly force the others into line, considering which it would seem the part of wisdom to make the necessary adjustments now, or at least between now and show time, so as to present a united front to the public then with the beginning of the 1921 buying season.

The following cars have been reduced in price to date: American, Bell, Bour-Davis, Chalmers, Chandler, Cleveland, Columbia, Crow-Elkhart, Essex, Ford, Franklin, Gardner, Grant, Hudson, Jordan, King, Liberty, Locomobile, Maibohn, Maxwell, Mercer, Moon, Overland, Paige, Stanley, Studebaker, Velie, Westcott and Willys-Knight. These trucks have been reduced: Day-Elder, Detroit, Diamond T, Federal, Ford, Gramm-Bernstein, Indiana, L M C, Maxwell, Patriot, Selden, Standard and Stewart. These tractors have been cut: Federal, Fordson and Sandusky.

The following car makers have increased prices: Anderson, Lexington, Pierce-Arrow, Roamer and Saxon. Among the trucks, Autocar has had the war tax added, in effect increasing the price by its amount.

Moisture Content of Wood Independent of Density

Even after long exposure to the same atmospheric conditions, different pieces of wood do not have exactly the same moisture content. Variations of 2 per cent were recently found in red oak blocks stored under carefully fixed humidity conditions at the Forest Products Laboratory.

These moisture differences, unlike variations in strength, are apparently independent of the density of the pieces. In the laboratory experiments, the variation proved to be as great in blocks of the same density as it was throughout the lot of specimens. Moreover, the range in moisture content was the same in wood of low density as in wood of medium density or high density.

Data on a few representative specimens are given in the accompanying table:

Density of specimen	Average moisture content in percentage of weight oven dry. Relative humidity at 80 deg. F. 38%	61%	88%
Low			
.519	7.6	11.2	19.4
.527	6.0	10.0	17.4
.536	6.5	11.0	18.2
Medium			
.630	7.7	11.3	18.9
.639	5.8	10.7	18.3
.643	6.8	11.3	19.5
High			
.720	6.4	11.2	19.3
.724	7.4	11.4	19.6
.753	6.1	10.8	18.8
Total Av.	6.7	11.0	18.8

Large Increase in Automobiles in Canada

Automobile registrations in Canada in 1919, according to U. S. Consul Felix Johnson, Kingston, Ont., aggregated 341,396 or practically five times the number in 1914. Prince Edward Island made the largest proportionate growth in registrations (3,019 per cent), whereas Ontario showed the greatest actual increase (113,080 more registrations), as between these two years. The returns by Provinces for the past six years were:

Provinces	Number of motor vehicles registered 1914	1915	1916	1917	1918	1919
Prince Edward Island	31	34	50	,303	639	967
Nova Scotia	1,324	1,841	3,012	5,350	8,100	10,290
New Brunswick	1,328	1,900	2,965	5,251	6,434	8,306
Quebec	7,413	10,112	15,335	21,213	26,897	33,547
Ontario	31,724	42,346	54,375	83,308	114,376	144,804
Manitoba	7,359	9,225	12,765	17,507	24,012	30,118
Saskatchewan	8,020	10,225	15,900	32,505	50,531	56,855
Alberta	4,728	5,832	9,516	20,624	29,300	34,000
British Columbia	7,628	8,360	9,457	11,645	15,370	22,420
Yukon Territory	43	69	89	93	87	89
Total	69,598	89,944	123,464	197,799	275 746	341,396

Customs statistics as regards Canada's imports of passenger and freight motor vehicles for the past four (fiscal) years show that the number and value of trucks has increased from 327 worth $423,824 in 1917, to 964 worth $1,275,179 in 1918, to 1,744 worth $2,274,748 in 1919 to 2,274 valued at $3,831,084 in 1920. At the same time passenger cars have varied, increasing from 12,037 worth $7,981,177 in 1917 to 16,318 worth $11,317,245 in 1918, then decreasing to 6,473 worth $5,326,510 in 1919, and again increasing to 10,805 valued at $11,204,461 in 1920. The averages which these summaries give show plainly the increases in both car and truck prices. Car averages are $663, $693, $823, and $1,037 for the respective years, an increase of 56.4 per cent or 18.8 per year. Trucks show these average prices $1,296, $1,323, $1,304 and $1,684, a total increase of 30 per cent or 10 per cent a year.

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The Fuel Situation

A WELL-MEANING correspondent takes us to task for our many and varied articles on the fuel situation. He says that any articles or data which point out the possibilities of fuel shortage in the near future are really a detriment to the industry, inasmuch as they may scare off prospective vehicle purchasers. In short, this correspondent asks that we gloss over or overlook entirely the facts of the situation so that a number of persons may buy cars under false representations in that they expect an unlimited supply of fuel in the future as in the past.

We hold that this position is entirely and wholly wrong. We believe that the automotive industry is headed by forward-looking men, who having the fuel situation sufficiently impressed upon them will meet it squarely, so that their vehicles can always be operated. If the fuel of the future is to be half alcohol, which requires a special design of motor, we believe the American vehicles of the future will be designed to utilize that fuel in the most economical manner, in short, when the manufacturers' whole interest has been centered upon the difficult fuel situation, they will meet it as it should be met.

The whole trouble goes back to the fact that the complete vehicle men ignored the fuel situation. They said in substance fuel supply or quality is none of our business, let the oil companies and the carburetor concerns straighten that out, we are busy building complete vehicles. The oil men, seeing that the industry was not united in the matter, would not make costly changes in equipment and methods. So the present situation was really brought about by the attitude of the vehicle manufacturers. Everything which has been published in these columns in the last 2 or 3 years bearing on the subject of fuels has been intended for those manufacturers, who previously would not listen, or listening, would not reason about the situation and act. We believe that our small efforts in this direction are now bringing results, which will benefit the entire industry.

In this connection, we suggest thoughtful consideration of the article elsewhere in this issue, dealing with alcohol. In connection therewith, it might be mentioned that the prohibition act has closed 236 distilleries and 1,090 breweries. Here are 1,326 potential producers of fuel alcohol. If they would turn out as many millions of gallons of this product as of their former products, it would make a very appreciable impression on the fuel situation, not alone for the moment, but for all time to come.

Price Situation Clearing

SINCE the time last month when the editorial entitled "Ford Does It Again" was written, the price situation has been clarified to a remarkable extent, and all concerned are looking forward to the turn of the year. To date some 29 car, 13 truck and 3 tractor manufacturers have announced reductions in prices. There have been no announcements of price changes in the last three weeks, so it may fairly be said that the reductions have run their course for the time being.

In analyzing what has been done, it must be noted that aside from Ford and one other make, those cars which have been selling best in recent months, that is quickest and easiest, are not included in the list, which aside from the exceptions just noted, include those who found it hard to dispose of their product and had in fact accumulated a surplus of vehicles for the first time in 3 or 4 years. Moreover, those which have been cut do not include the large producers (with the above two exceptions) so that the makers whose products run into the largest per annum totals have not as yet touched their prices. Considered in that light, it will be found that a very small percentage of the country's output is reduced in price at this moment. Against the 45 makers who have announced reductions, it should be noted that the United States has a total of car, truck and tractor manufacturers of about 600, so that the reducers amount to 7½ per cent of the total. Or to put it the other way around, 92½ per cent of the makers have not as yet indicated any price changes.

It is around the intentions and final actions of this larger percentage of the makers that the present interest centers. If many of them reduce later on, there is no question but the weight of public opinion and their influence combined, will force lower material prices, in fact light tendencies in that direction are already noted. It is for this reason that we repeat as our opinion the statement that the situation will clarify with the turn of the year, by which time "the other makers will be in a position to announce (or will have announced) the prices applied to their 1921 models and the presumption is that the larger number of makers will make no reductions until the announcement of the new models which will carry the reductions."

Henry and Edsel Ford have purchased the Detroit, Toledo & Ironton Railroad, a coal carrier from the mines of West Virginia, Southern Ohio and Kentucky. The road is unique in that it avoids all cities, and thus coal may be run through to the River Rouge plant without having cars held up and possibly confiscated at city terminals.

Bankers Find Motor Vehicles Business Assets

Both Rural and City Financiers Report Large Gains Through Their Use

AS a people we are progressive and think forward, of tomorrow rather than of yesterday. Our bankers however are ultra-conservative and think backwards, basing their ideas of today and perhaps of tomorrow only upon what occurred yesterday. The recent financial situation has emphasized this, for the major part of the present trouble started when western bankers ruled that automobiles, motor trucks and tractors were luxuries, at least were not essentials. Subsequently, they were obliged to deny ever making such a ruling, or in fact, ever having had such thoughts, but the fact remained that they would not lend money upon automotive paper, and in fact did everything to discourage automotive buying, and this fact speaks for itself.

This is not particularly surprising, for the banker has always been a handicap rather than a helper, to the industry. And yet even the banker must realize that the world moves and that conditions have changed. Perhaps in 1900 the banker was justified in figuring that the automobile was an uncertain thing; it might be but a passing fad, it certainly then did not appear as the basis of a very large, most stable and extremely profitable industry. Yet in the intervening 20 years there have been tremendous changes. Today, there are approximately eight millions of vehicles in daily use, which have been manufactured by a basic industry giving employment to more than 800,000 people, while accessories and other contributing industries employ almost as many more. Engaged in the selling of and service for cars, trucks and tractors, accessories and parts, there are in this country alone approximately 32,000 car dealers, more than 18,000 truck dealers, about 42,000 supply dealers, over 42,000 repair shops, more than 36,000 garages and in excess of 4,400 charging stations. Even on an extremely conservative basis, these establishments must employ more than 300,000 people. That portion of the oil business devoted to the production, refining, transportation and sale of fuels and lubricants for automotive vehicles exclusively must include the employment of more than 100,000 people. Even if the subject be pursued no further, this totals two million people dependent in one industry or another upon automotive vehicles for their living. Adding in the two million chauffeurs, we have four millions dependent on automotive vehicles for their living, and added to the eight million owners and users, there is a total of twelve millions vitally interested in this industry. Taking the latest census figures available for the country's population, this works out to more than 1/9 of all the people. That is, considering the whole country, one person in each nine is vitally concerned in the automotive industry. Considering this it is small wonder that the ruling of the aforesaid bankers caused such a country-wide outcry.

But not all the bankers feel that way. In fact, many rural bankers go to the opposite extreme and not only admit that cars are a necessity but go enough farther to claim that they are a business requirement, and as such, a business asset.

Bankers are increasing the output of their business 33 percent through use of the automobile. Financiers in rural districts say that more loans, better inspection of properties, sounder acquaintanceship with their clients, is made possible by means of the automobile. Many country bankers estimate the increased volume of trade due to motor travel at over 50 per cent. Some put the added increment at several hundred per cent.

Thirty-four Per Cent Improve Living Conditions

These statements are based on replies to car owners of varied occupations in ten major states of the union by the National Automobile Chamber of Commerce.

The figures compiled from these replies average as follows:

Bankers

Annual mileage 6,334
Annual mileage used in business
2,185 (34 per cent)
Average increase in business due to car ownership.....33 per cent
Percentage of owners improving their living conditions through motor travel.....34 per cent
Mileage used instead of railroad or trolley
1950 (31 per cent

The average figures however do not tell the story very clearly because the conditions vary considerably between the city and the country bank business. The city banker uses his car comparatively little in his commercial affairs because so much of his work is within the four walls of an office. Consequently the direct gain which his car can bring him in business is small. On the other hand, the reports from urban sections show a heavy percentage of banker users who improve their living conditions through automobile travel. City dwellers are enabled to live comfortably in the suburbs through ownership of a car. This factor on the other hand, is of small interest to the country financial man who has all the fresh air and green grass that he wants.

Car Owners Increase Business 57 Per Cent

Rural bankers are not the only ones who find their business efficiency and field of operation increased or widened. More than 6,800,000 business men added 57 per cent to their productive efficiency during the past year. More than 2,300,000 families have found it possible to live in the suburbs or otherwise improve their home surroundings. A working force equivalent to 1,600,000 laborers is being applied to farming. Such is the creative effectiveness of the passenger car, as reported in replies to thousands of cards sent to car owners.

This questionnaire, conducted by the N. A. C. C. went to automobile license holders taken at random from the registration lists of ten widely diverse states: California, Iowa, Massachusetts, Minnesota, Nebraska, New York, Ohio, Texas, Virginia and Wyoming. The card asked the owner's occupation the annual mileage, the amount of mileage used for business and for recreation the amount used to supplement or in lieu of trolley or rail connection. It asked to what extent the passenger car increased the

owner's business, and whether it affected his housing problem or living conditions. The present figures are compiled from answers to the first 10,000 cards of this survey which is being further extended until information on the uses of cars by all classes of owners is fully determined.

Ninety Per Cent of Cars for Business

Ninety per cent of the owners reported that they used their cars more or less for business, while 10 per cent stated that their automobiles were for recreation use only. The average increased efficiency of the car owner is 56.7 per cent. A number report but small gain in productivity, but this is heavily overbalanced by the testimony of the farmers who have added nearly 70 per cent to their labor effectiveness, and by the doctors and salesmen whose business is doubled, tripled and in some cases quadrupled through use of the car.

Net Gain of 3,000,000 Men

The use of the passenger car, accordingly, has meant a net gain to industry of 3,000,000 men. There are more than 7,000,000 automobile owners in the country, each increasing his efficiency 56.7 per cent through the use of the car, making an addition to the business productivity of the country in excess of 3,900,000 workers. As there are between 800,000 and 900,000 men manufacturing and selling passenger cars, parts and accessories, there remains a net gain of more than 3,000,000 men. If one were to add the productive efficiency of the 750,000 motor trucks now in use a still greater gain would be shown.

Farmer Greatest Gainer

The largest gain in productivity has been in farm life. There are 2,367,000 farmers owning cars. The answers from farmers reported 68 per cent increase in productivity of the owner or an addition equivalent to 1,600,000 hired men.

Big Relief in Housing

Norman Angell in "The Great Illusion" predicted that war would be impossible because it would mean national suicide. But he did not take into account the infinite ingenuity of man. In America the passenger automobile has been the great factor in solving reconstruction problems. The cessation of building during the war has meant overcrowded conditions everywhere. But 37 per cent of the car owners, 2,300,000 families, are finding the automobile a help in this situation, enabling them to live in the suburbs, and otherwise improving their living conditions.

The railroad and trolley lines which have been handicapped by war conditions are being relieved and supplemented by automobiles. Sixty-two per cent of the car owners report that they use their motor vehicles instead of traveling by rail or electric line. Over one-third of the total automobile mileage is used in this way.

Every Walk of Life Aided

The passenger car has brought increased efficiency in every walk of life. The heaviest users are farmers with physicians and salesmen next in line. Contractors, real estate dealers, and insurance men find cars especially useful. Manufacturers and merchants are among the larger classes of automobile owners.

Among the other classes who answered the questionnaire were: bankers, carpenters, mechanics, architects, barbers, teachers, clergymen, wholesalers, artists, undertakers, mail carriers, builders, plumbers, credit men, public accountants, government officials, tobacco brokers, lawyers, hotel men, theatrical men, oil men, superintendents of docks, musicians, miners, railroad executives and others.

Bankers Find Car a Utility

Forty per cent of the bankers who replied to the question card found the car a help in their business. A Minnesota banker reports that the car has multiplied his business efficiency "ten times." Another writes: Car use, even on pleasure trips, gives a banker much better understanding of his customers, particularly livestock customers." A third writes of his car's use in business: "I cannot do without it."

Makes Life More Worth While

In addition to the business use of the car comes much testimony that the owner has had much more opportunity for education, cultural things, and healthful recreation through his automobile.

One farmer writes: "If it was not for the car we could not have any social life to speak of."

Another says: "Enables me to live nearer better schools, surroundings and still do 50 per cent more business. Couldn't get along without a car."

And a third reports: "I can live in the country with all the advantages of living in town."

The balance of the report, that is the tabulation of the information from the cards received subsequently, will be awaited with considerable interest. However enough has been said previously as a result of the analysis of the earliest data to reassure anyone who might have any lingering doubts as to the stability and permanence of the country's second largest industry. As level-headed an observer as Col. John W. Prentiss, associated with Hornblower & Weeks, leading banking house, has estimated that the world will absorb more than thirty million (30,000,000) automobiles before the saturation point is reached. There are in use in the world today less than 8,500,000 automobiles. The average production of this country for four years, 1917, 1918, 1919 and 1920 (estimating 1920 liberally at two million cars), was less than 1,750,000 cars. Allotting to the rest of the world enough to make the yearly production figures of cars alone two millions, there still remain more than 11 years before the saturation point will be reached, and if allowances be made for the number of cars which will go out of service between now and then, more than 25 years.

Even at that, when this saturation point is reached, on the basis of a car being worn out so as to need replacement every 6 years, the replacement business alone will amount to 5,000,000 cars a year, so it may be seen that the industry faces a long, prosperous life.

The average value of all cars has ranged up as high as $2,635 before the war, down as low as $1,600 since then, and for 1920 was placed at $2,537. Recent reductions, and those still to come, will cut this down to less than $2,400 or perhaps to $2,350. Even if it be taken as low as $2,000, an annual production of 2,000,000 cars or more is going to mean a value of $4,000,000,000 or more a year. A total of 16,000,000 cars in use in this country (out of 30,000,000 in the whole world) at an average valuation of $700 (considering the value of the oldest as well as the newest, and all in between) would give a total public equity of $11,200,000,000. So, it can be seen that bankers are going to have plenty of profitable business from the automobile industry in the years to come.

Government Engineers Testing Effect of Trucks on Roads

New Study Being Made of Motor Trucks at Various Speeds and Loads and Their Effect Upon Various Types of Road Surface—Impact Tests

WHILE one result of the tests now being conducted by investigators for the bureau of public roads, U. S. Department of Agriculture, as to the effect of motor trucks upon highway surfaces, may be a change in taxation, that is a possible increase in truck taxation, the real value will come from the determination of the best types of road construction to resist truck road wear, and through such determination, the elimination of much waste of time, effort and taxpayer's money through the building of the wrong kinds of roads. Truck transportation is here to stay, and it is of vital importance that this fact be made prominent. This being the case, it is not so important to know that trucks do wear the roads out, that might almost be taken for granted. What is of the greatest importance in such a situation is to know what type and kind of road construction will present the greatest opposition to such wear, that is will wear the longest under such truck traffic. Knowing this, it will be possible to build the roads of this type and thus build those forms which will give the greatest all around satisfaction.

The scientific experiments include tests already made which show that increased speed of a vehicle equipped with hard rubber tires (that is solid tires as distinguished from pneumatics) tremendously increases the impact which the wheels make on the roadway where there is an evenness. On the other hand, where pneumatic tires are used increased speed adds comparatively little to the impact. It has been suggested that these tests will be of great value not alone in settling questions of truck and road design but may lead to a rational basis for determining license fees for motor vehicles.

Trucks have been used in these tests varying in size from a 1 ton truck up to a 7½ ton truck carrying an excess load. Each truck was run over a special recording device embedded in a roadway and the impact which resulted when one of the wheels made a 2 in. drop from a ledge built in the surface caused the deformation of specially prepared copper cylinders forming part of the apparatus. The magnitude of the blow was accurately ascertained in pounds by measuring the extent to which the cylinder had been forced out of shape.

Recent tests were made with a 3 ton truck of well known make with a 4½ ton load so that the total weight on each rear wheel was 7,000 pounds, the unsprung portion (that not supported by the springs) being 1,700 pounds and the sprung portion (that portion supported by the springs) 5,300 pounds. The truck was equipped first with an old solid tire that had been worn down to a thickness of 1 inch. Then, with exactly the same load on the truck, a wheel was used fitted with a new solid tire 2½ inches in thickness. And finally, the truck was equipped with pneumatic tires 42 by 9 inches and blown up to a pressure of 142 pounds per square inch. The following table shows very clearly the bad effects an old tire is likely to have on a road surface and the greatly lessened impact produced by trucks when they are equipped with pneumatic tires. The tests show that as the vehicle's speed increased the impact from the old hard rubber tire increased greatly. The impact from the new hard rubber tire was somewhat less.

Results of Impact Tests

Approximate speed	Height	Old tire	New tire	Pneumatic tire
5.7	2 in.	11,600	9,400	7,100
10.2	2 in.	18,500	14,100	7,800
14.6	2 in.	26,500	18,700	8,300

Related to these tests is another series which utilizes the figures secured in the first experiments. A number of paving slabs were tested by means of a machine designed to give impacts equivalent to those produced by the rear wheel of the heavy truck already referred to. The unsprung portion of the weight of this machine is 1,500 pounds and the sprung portion weighs 6,000 pounds. The tests were made by raising the entire weight through a height of one-eighth of an inch, allowing it to fall 500 times, then to a height of one-half inch with 500 repetitions, then three-eighths inch more in height, and so until the slab failed. To date, about 12 slabs have been tested, laid on a rather wet subgrade. A surprising difference has been found in the strength of the different types of pavements tested. The total number of blows required to cause failure have varied with the different slabs from 67 up to almost 2,000. All these data promise to be of the greatest value to engineers in selecting material for roads.

The Bureau of Public Roads is also making a study of the relative wearing qualities of different types of pavements and tests have been about completed on a short section of pavement containing 49 different types subjected to the wear of a special truck equipped with five large cast iron disklike wheels. The relative wearing qualities of hard as compared with soft brick are brought out very distinctly in this test. The resistance to wear of various kinds of stone block sections is also shown up to good advantage. A chance to compare grout and asphalt fillers for both brick and stone block is furnished by this investigation. Likewise the relative wearing qualities of concrete mixed with various aggregates is indicated.

The investigation of subgrade materials, started a few months ago with the cooperation of the district engineers and state engineers, is proceeding at a very satisfactory rate. A number of samples have been received from various parts of the country and laboratory analyses of many of these samples are partially completed. The methods being used by the division of tests will shortly be published as a paper so that any other laboratories wishing to conduct similar investigations may have some guide as to the procedure of the Bureau of Public Roads.

The samples analyzed have been taken from parts of the roads that have failed very badly as well as from adjacent parts of the same roads that have withstood heavy traffic successfully. It is hoped that by a comparison of the laboratory results on these samples with the reported behavior of the road in service differences in the subgrade materials will become apparent so that we will be able to say what physical characteristics soils must possess to give them high bearing values.

Simple Truck Body for Contractor or Farmer

IN a broad, general way, the contractor or contracting builder probably has as much use for a truck or trucks as anyone, that is the nature of the contracting business is so varied, so changeable, and includes the handling of such heavy and bulky material, that in this line of work all trucks probably are worked at capacity the maximum part of their time. Right now the call for new buildings, especially factory, office and loft buildings is very strong and there is a great deal of work done along these lines, although it is so widely distributed that the general public sees and hears little of it. Consequently, the majority of contractors are pretty busy, and as soon as prices of building material recede, as they promise to do shortly, in company with those other materials which have already shown large decreases, they will be even more busy.

While freight handling is improving rapidly, and is supposed to be much better than a few months ago, it still leaves much to be desired. This brings about a situation in which the motor truck is of the greatest utility and economy to the contractor, especially in the smaller twon, where freighting conditions are perhaps worse than in the larger cities. For these reasons there is a great demand for practical truck bodies for placement upon old passenger car chasses, says Blacksmith and Wheelwright.

A brief review of the whole situation would show: first, a big demand for building materials; second, the need for practical trucks; third, a shortage in trucks; fourth, the conversion of passenger cars to trucks by the installation of truck bodies; fifth, a big demand for truck bodies which cannot be filled by the manufacturers. Obviously then, the harvest is ripe for the small manufacturer. The individual with a small amount of working capital and a reasonable equipment of wood and metal working tools, may make money by building truck bodies.

Competition in truck bodies is reduced to a minimum, the demand is greater than the supply; profits are assured and the smith is best equipped to produce the truck bodies because he is in personal touch with the men who wish them. In different localities circumstances and conditions call for changes in construction.

The truck body reproduced in Fig. 1 below is designed especially for the contractor and builder, but should be of value to practically any farmer. It is designed to carry sand, cement, lime and the like, while at the same time it is heavy enough to carry loads of lumber and other building supplies. The body measures 8 ft. 10 in. in length, which is long enough to support 12 ft. lengths of boards. If the load is light, even longer strips may be loaded, since the rear wheels fall about midway of the body. The body overhangs the wheels and is 5 ft. 6 in. in width.

In this particular case, a Studebaker chassis is shown This machine has a wheelbase of 125 in. and is heavy enough for the purposes; however it is not feasible to carry a load of crushed rock or building blocks.

As a foundation for the body two chassis rails are pro vided. These rails measure 8 ft. 9 in. in length; 3 in. thick and 7 in. wide and should be spaced so as to rest upon the frame or upon the body supporting irons. At right angles to the frame members are six cross bars measuring 5 ft. 6 in. in length by 3 in. thick by 7 in. in

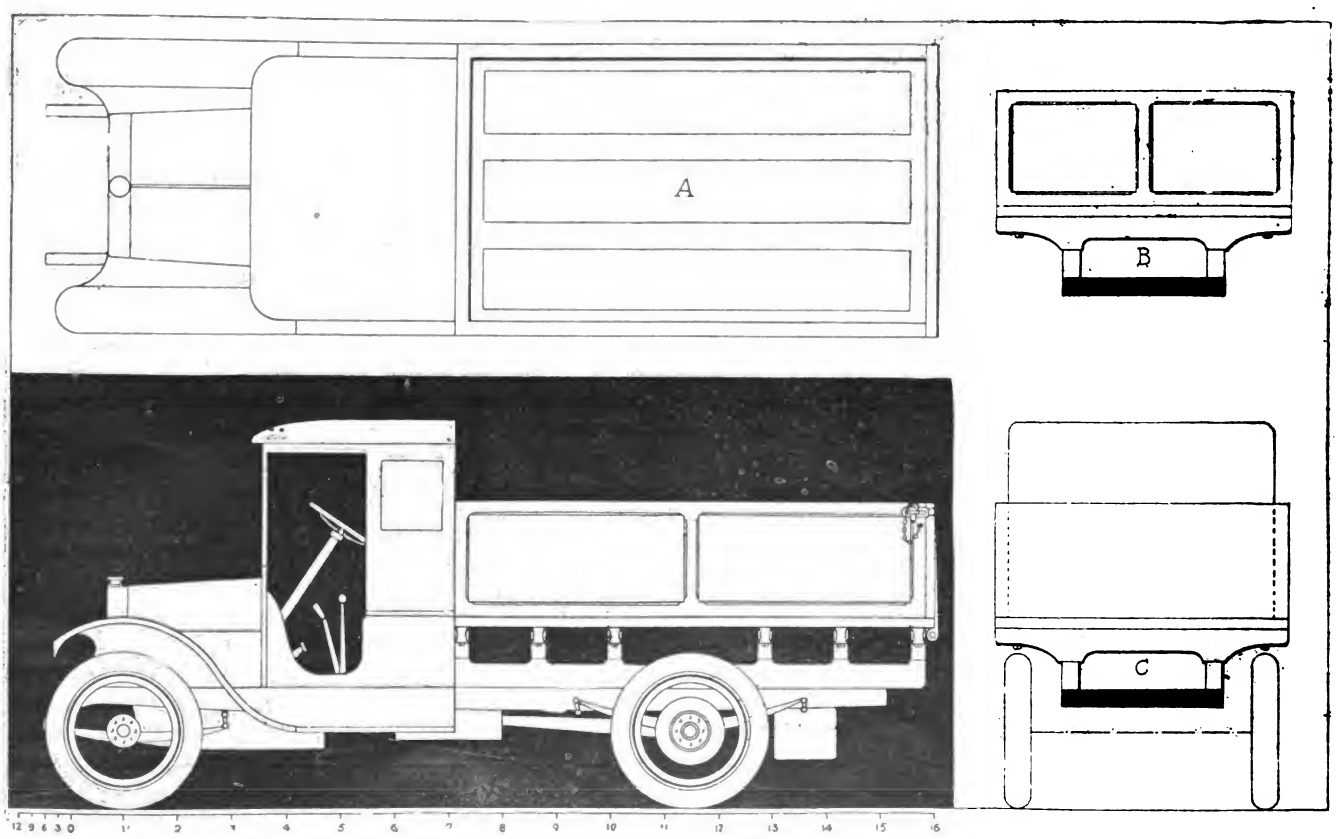

Fig. 1. Simple truck body, most suitable for contractors but handy for farm work and other. Studebaker chassis of 125 in. wheelbase

width. In placing these bars, be sure to allow clearance for the rear wheels. The bars are bolted to the chassis rails as well as to the body sills.

The body sills, four in number, measure 8 ft. 10 in. in length. The outside sills are made from 3 in. plank, 5 in. wide, while the two inside sills may be made from 2 in. plank of the same width. The end sills are 4 ft. 6 in. in length, 3 in. thick and 5 in. wide and are fastened to the body sills with lag bolts and angle irons.

The bottom of the body is made from 2 in. stock 8 ft. long. The sides of the body are constructed upon side rails 2 in. thick, 4 wide and 8 ft. 10 in. long. A practical height for the sides is 2 ft. to 2 ft. 6. A center upright on each side gives a panel effect.

Beaering in mind the fact that the body will be used for barrels or boxes it will be well to place four iron runners along the bottom.

If the body is to be used by a farmer or grocer stake irons may be placed upon the sides, thus enabling him to pile in baskets of produce or even hay in season. Since the body is placed high upon the chassis, there is ample room for tool boxes between the cross bars. A special compartment for spare tires may be built between the chassis rails at the rear if pneumatic tires are used. The body calls for no fine work or careful fitting of joints and may be done by practically any smith.

Nickel Production in Canada

The total production of nickel in 1919 amounted to 44,542,953 pounds, which at 40 cents per pound, would be worth $17,817,181 as against 92,507,293 pounds valued at $37,002,917 in 1918.

The production as usual, represents the nickel in the matte produced from the treatment of the ores of the Sudbury district and the Alexo mine at Porquis Junction, Ontario, supplemented by the recovery of a small quantity of metallic nickel, nickel oxides and other salts, as by-products in the treatment of the silver-cobalt-nickel ores of the Cobalt district.

The production of nickel-copper matte at the smelters of the International Nickel Company of Canada, and the Mond Nickel Company, amounted to 42,736 tons containing 12,098.7 tons of copper and 12,035.3 tons of nickel, the average percentage of the combined metals in the matte being about 80. The production in 1918 was 87,184 tons of Bessemer matte containing 45,885.6 tons of nickel and 23,482.3 tons of copper. There were mined in 1919 572,400 tons of ore and smelted 754,567 tons, as against 1,641,617 tons mined and 1,559,892 tons smelted in 1918.

Refined metallic nickel has been recovered in Canada since 1915, but previous to 1918 only in small quantities, and as a by-product in the smelting and refining of the silver-cobalt-nickel ores, as stated above.

The new refinery of the International Nickel Company of Canada, Ltd., at Port Colborne, Ontario, started operations in July, 1918.

The total production in Canada of refined nickel from both the Sudbury and Cobalt district ores amounted to 5,063 tons, as against 1,204.5 tons in 1918. The other products recovered were: 581.4 tons of nickel oxides valued at $340,033 as against 282.4 tons valued at $169,447 in 1918; 199.6 tons of nickel salts and nickel castings valued at $46,358 as against 186.3 tons valued at $39,598 in 1918.

The British America Nickel Corporation practically completed in 1919 the construction of its smelter at Murray mine and of the refinery at Deschenes, Quebec. The smelter started operations January 18, 1920, and the refinery will probably soon be in operation. The capacity of the plant will be about 7,000 tons of nickel and 3,500 tons of copper per annum.

Total nickel contents of matte produced amounted to 44,070,609 lbs. with no figures available for nickel in silver-cobalt-nickel ores.

Of this total, 41,016,400 lbs. were exported 30,395,400 in the form of matte or speiss, and 10,621,000 as refined nickel. The United States took 34,881,500 lbs., Great Britain 4,617,900, and the other countries of the world, 1,517,000.

Light Creosote Oils in Wood Preservation

Present shortage of all kinds of wood and high prices emphasize the need for proper preservation. Light creosote oils properly injected into wood apparently will prevent decay until the wood wears out or until it checks so badly that the untreated portions are exposed. Such is the indication of service records collected by the Forest Products Laboratory on railway ties and telegraph poles preserved with low boiling creosotes.

Creosotes used in ties from 25 to 50 years ago were for the most part oils having 50 per cent or more distilling below 235 deg. C., with a residue not to exceed 25 per cent at 315 deg. C. The ties so treated lasted from 15 to 20 years, and failure was traceable in most cases to mechanical wear, such as rail cutting and spike killing. In no case was failure found to be the fault of the preservative.

Of 1,558 telegraph poles in the Montgomery-New Orleans line, which were pressure treated with a light creosote oil, 1,049 poles were still sound after 16 years. In 91 per cent of the cases of decay, the fungi had entered the wood through checks and shakes. Representative sections in the Norfolk-Washington line showed that after 17 years' service, of the 1,614 poles inspected, 1,469 were sound, 92 decayed at the top, and 105 decayed at the ground line. The decay at the top was caused chiefly by cutting off the poles. In those decayed at the ground line, the causes of failure, as determined in 88 per cent of the cases, were checks or shakes. Here again as in the ties, the preservative outlasted the mechanical life of the wood.

Unless some other factor than protection from decay is considered important therefore there is apparently no need to specify high boiling oils. The important point is that any coal tar creosote which is not extremely low boiling or extremely high boiling will satisfactorily prevent decay, and in the selection of an oil, factors such as price, penetrability, and convenience in handling should receive greater consideration than moderate differences in volatility.

There are about 600 motors in Tientsin this year as against 400 last year. A truck line is being established from Peking to Tungchow and from Tungchow about a third of a mile to the Western Hills. Other lines are being established from Chinhaishin and from Techow to the interior of Chihli Province.

For the year ending July 31, 1920, the Ford Motor Company of Canada had net profits of $4,686,243 from a production of 55,616 cars, after deducting almost a million for taxes and other expenses. On the relatively small capitalization of $7,000,000 this amounted to 67 per cent.

Theory and Practice of Lubrication---the Germ Process

By HENRY M. WELLS and J. ED SOUTHCOMBE*

PERFECTION of lubrication in the early days of the mineral lubricating oil industry was considered to lay with the production of the purest hydrocarbon oils. It is a monument to the skill and efficiency of producers and refiners that this search for better lubricants and more scientific methods of refining has resulted in placing upon the market an enormous range of highly purified lubricating oils of every conceivable viscosity, gravity and color. This has conduced to lubricating efficiency and has been instrumental in assisting to the greatest possible degree the development of engineering design.

Nevertheless we find that for many purposes, particularly those requiring lubrication of bearings, etc., carrying heavy loads at relatively slow speeds, these pure mineral oils have not been ideally successful. The need for adding to mineral oils, animal and vegetable oils to increase their "slipperiness," has been forced upon users in all countries. To take a few examples, the specification for lubricating oils of the U. S. railways, drafted at a recent conference, recommends the addition of four to eight per cent of fatty oil. In Great Britain many large consumers of lubricating oil, the railways companies and the government departments emphatically specify oils containing as much as 20 per cent of pure ripe olive, lard, or cocoanut oils. The fact that such compounded oils possess exceptional friction-reducing properties has been shown by a large number of trials and experiments on mechanical testing devices and is supported by observations in practical lubri cation.

We can testify to the importance of compounding as we shall show both as the result of our experience of practical lubrication extending over every known type of prime mover, and confirmed by a series of special laboratory tests, physical and mechanical.

It is to this peculiar friction reducing property, possessed by many animal, vegetable and compounded oils, that the term "oiliness" has been applied to express that remarkable ability to maintain efficient lubrication under conditions of high load and slow speed. This cannot be accounted for by viscosity alone and Professor Boys, a leading English physicist, has crstalized the position very happily in the following terms. Speaking in the Presidential address to the Physical Society in 1908. he said: "It was found that the lubricating property of oil depended upon something which at present is unknown—it is not viscosity—animal and vegetable oils lubricate better, that is to say, they are more slippery than mineral oils of the same viscosity and although the oil trade has known how to make good slippery mixtures, no one at present knows what oiliness is, and this is at the present time an important physical quest of the engineer.

For this reason, an extensive industry has grown up for the production of fatty oils to be used in compounding with hydrocarbons. Here again, the demand for greater purity and freedom from acidity of glycerides has been insistent and has been the means of marketing of expensive acidless tallow oils, acidless lard oils, etc. It is our object to show that such highly refined oils are not only necessary but positively ineffectual in securing the highest possible degree of friction reducing efficiency.

Various Oil Properties and Their Value

In the beginning it was our object to elucidate the reason for the superiority of the fatty and compounded oils as friction reducers, and to this end we collated and studied all physical properties of the liquid which could influence its character as a lubricant. These properties are, specific gravity, viscosity, capillarity or surface tension, compressibility and tensile strength. The other commonly determined physical factors such as flash-point, volatility and fire test, important as they may be in the choice of an oil, do not materially influence the frictional properties.

Examination of these groups of physical constants show that a large number of mineral oils may possess the same specific gravity as fixed oils, but behaving differently as lubricants. This satisfied us that gravity played no deciding part. Viscosity is of course of primary significance under conditions of high speed and copious supply, but as mentioned, it does not constitute a criterion under the special conditions where compounded oils are found advantageous.

We satisfied ourselves that compressibility and tensile strength had no dominating significance, but were forced to the conclusion that the only property of importance which had not been adequately studied, was capillarity or surface tension. Consider the case of two eccentric glass surfaces which are being forced together with a drop of oil or mercury between them. Now since the mercury does not wet or spread over the glass, the meniscus will be convex to the liquid. In the case of oil which wets the surface, the meniscus will be concave. In the first case, the tendency on capillary grounds will be for the liquid to gather itself up into a drop and to pull the liquid film away from the narrower constricted area of greater pressure. In the case of oil, the opposite will be the effect. The oil, owing to its meniscus will tend to force itself into the narrow spaces.

This is exactly what is required in a lubricant, namely, that it shall penetrate into the narrow spaces between journal and bearing and from the above considerations one clearly sees that liquids which do not wet solid surfaces cannot be described as lubricants. Only the liquids which wet the solid surfaces possess lubricating power in the generally accepted sense. This convinced us that a measure of the surfaces tension would shed considerable light on the problem and to this end we devoted attention. The usual surface tension measurement is that of oil against air and we confirmed the opinions of previous investigators that the results so obtained shed no light at all on the question under consideration.

The interfacial tension between the solid metal and oil unfortunately cannot be measured. There remains one other means of getting information on this subject, namely, the interfacial tension between oil and another liquid. We measured the interfacial tension between various types of oils against water and lastly against the liquid metal mercury. The results obtained were startling in the extreme.

*Extracts from paper read before Natl. Petroleum Assn., Pittsburgh. Authors are fro mLondon, Eng.

Fatty Acid Decreases Interfacial Tension

It was found that the infacial tension against water and also against mercury of the fatty oils and compounded oils, was much lower than was the case with any mineral oil. At this point we had succeeded in formulating a test which distiguished between the physical properties of mineral and compounded oils. The matter might have remained at this stage had we not pushed further to inquire the reason for this remarkable anomaly. After a great amount of investigation, we proved definitely that this difference was due to the presence in the fatty or compounded lubricants of small quantities of free fatty acids, absent in mineral oils. This was most surprising since it indicated that the virtue of fatty oils arose from the fatty acids which they contained, as impurities. Then we artificially prepared oils consisting of 99 per cent mineral oil and 1 per cent of free fatty acid. These gave a low surface tension. On the other hand, we removed the fatty acid from fatty oils and found that the pure fatty oils gave a high surface tension. We drew the deduction therefore that the friction reducing properties were due solely to the fatty acid content and that it should be possible to obtain the desired result by adding minute quantities of fatty acids to mineral oils.

At this point it became essential to confirm the results by direct experiments on bearing surfaces, which results have been completely confirmatory. It should be remembered that all the commercially occurring fixed oils contain notable quantities of free fatty acids and even if such acids have been removed by careful refining, hydrolysis soon sets in and free acids are formed which in even relatively minute quantities suffice to lower the surface tension. The possibility of corrosion arising from the presence of these fatty acids is negligible, and in fact, less likely than when using compounded oils, because in our case, we only add minute quantities (about 1 per cent) which are controllable and can never increase, whereas when one uses several per cent of fatty glycerides it is possible by hydrolysis to obtain very large quantities of free acids.

When it comes to laboratory testing devices we confess that we have very little faith in the usual type of mechanical friction machine. Such machines at high speeds and comparatively light loads are little better than viscometers and do not measure adequately the true oiliness of the lubricant. If the machine be designed to carry heavy loads at very slow speeds, insuring a certain amount of contact friction and if the series of oils tested possess similar viscosities and gravities, one obtains a true measure of the relative oiliness. We have proved our contentions on four distinct machines of special types arranged for investigating contact friction.

Testing Machines Used

Two were of the Thurston type with a journal 3.8 in. in diameter giving approximately 1 ft. peripheral, working under loads of 200 and 270 lbs. per sq. in. with rubbing speeds of 7 ft. and of 11 ft. per min. The machines were provided with automatic recording gear and special precautions were taken to insure true alignment of bearings and journal. One machine was operated by ourselves and another quite independently and without any suggestion from us by L. Archbutt, chief chemist of the Midland Railway Co., a prominent English authority on lubrication. The third machine was run at the National Physical Laboratory, London, and is the device invented by Mr. Lanchester of automobile fame. It consists of a worm wheel mounted on a driving shaft and engaging with a worm gear in a box pivoted at its center in such a way that the torque can be measured. From a measurement of the horsepower, the efficiency of the gear with various oils can be calculated. By means of a screw, pressure can be applied between wheel and worm up to several thousand pounds per sq. in. The fourth machine is the invention of R. M. Deeley, chief mechanical engineer of the Midland Railway and is unique in that it is designed to measure static friction.

The machine is arranged as follows: 3 pegs, each 5/32 in. in diameter are secured concentrically to a disk which can be weighted as desired and actuates a spindle to which a spiral spring and recording finger is attached. These pegs are then placed upon a bottom dish of metal which can be rotated slowly. When the lower disk is rotated, the pegs are carried with it by the friction, and when the surfaces only slip, owing to the tension of the spring, the finger then gives the frictional resistance. The movable disk upon which the pegs rest, lies in a circular dish which can be filled with oil. To insure clear surfaces, the rubbing metals are ground in water with flour of carborundum. They are then polished with fine, wet emery, rubbed well in water with a cork to remove the emery, dried with blotting paper and finally heated in an electric oven to get rid of all traces of moisture.

The broad set of tests and results from the four machines were these: Oils used were a pure mineral oil, the same plus a half per cent commercial fatty acids, the same plus 1 per cent and 2 per cent of fatty acids. These were tried out against rape oil containing 2.4 per cent of free fatty acids and neutral rape oil from which the fatty acids had been completely removed in the laboratory. In every case, on each machine, the frictional resistance when 1 per cent of fatty acids was used was reduced by 20 to 26 per cent. To achieve this reduction by the use of pure neutral rape oil it was necessary to employ as much as 60 per cent. Further experiments with olive oil show that the addition of 2 per cent of commercial fatty acids lowers the friction 30 per cent below that of a mixture containing 40 per cent mineral and 60 per cent olive. To put the matter in a nut shell, the frictional resistance shown by any mineral oil can be most definitely reduced by the addition of about 1 per cent of commercial fatty acids.

This is in complete conformity with the latest views of pure science.

All recent work points to the fact that it is the chemically reactive and unsaturated constituents of lubricants which promote "oiliness" and that they do so by forming new "composite" films on the surfaces lubricated with lower surface energy and opposing less resistance to shear.

We have hitherto confined our remarks to the effects of acids on the friction-reducing properties of oils, but there is another aspect of utmost importance. In practical use in power house or factory, lubricating oils are not used under ideal conditions and in many cases, become admixed with water. In some cases it is necessary that when the oil comes in contact with water, it

shall mix with the water or emusify. Such cases are the bearings of marine engines and the guides and rods of locomotives, etc. In other cases, it is essential that the oil shall not mix or shall separate readily from the water.

We found also that it is possible to choose suitable acids which will confer upon the mineral oil these particular and valuable properties. By the addition to the mineral oil of one class of fatty acids, we induce a tendency to de-mulsify, while other groups of acids have a powerful emulsifying influence. We are therefore enabled to change the character of the mineral oil not only in relation to its properties as a reducer of friction, but also to decide its behavior under any given set of circumstances in which it may be employed.

Germ-process oils have been extensively tried out by the British Admiralty, government departments, steamship and railroad companies, without a single failure being recorded.

On large gas and oil engines, especially big horizontal units, where previously 10 per cent fatty oil was used, we have been able to substitute germ oils having 1 per cent fatty acid with complete success.

Steam Cylinder Lubrication

For "perfect" lubrication of steam cylinders with certain types of valve gear (as one example, "Corliss"), and for engines working under certain conditions—say with much condensation in the cylinder—a compounded oil is essential.

Germ process oil incorporated in very small proportion with the correct mineral cylinder oil gives equally good results on engines with Corliss valves up to 3,000 h.p. working at 160 to 170 lb. per sq. in. pressure, superheated 480 to 500 deg. F.; on horizontal engines with Corliss valves up to 750 h.p. up to 160 lb. pressure without superheat. Various mineral cylinder oil bases to correct "germs" in different but small proportions give thoroughly good lubrication on vertical and horizontal engines of many types, sizes and pressures.

Marine Steam Engine Bearings—Open Type

For a good heavy marine engine oil it has always been considered necessary to use from 10 to 25 per cent thickened or blown oil—as a rule, thickened rape oil. This gives great viscosity, also very good "lathering" properties to the oil. The standard specification for marine bearing oil for one of our semi-government departments is a compound of about 20 per cent "of fatty oil"; but the total fatty acid content must not exceed 1 per cent. This has now been successfully replaced by "germ process" marine engine oil.

On February 5, 1918, we filed our patent* for oils made on this new process, and immediately its "publication or communication" was prohibited by the Admiralty, who carried out trials over many months on about fifteen ships of the mercantile marine, including a fair proportion of liners. The result was satisfactory. The germ process gives to a mineral oil of fair merit that property lacking for some purposes, while it increases the lubricating value of a "good oil" making it still better. In all cases they become more economical.

On a cruiser the port engine was run on a straight mineral oil and the starboard on a germ process oil. It was found possible to reduce the oil feed on the latter engine and the engineer officer reports that he would be quite willing to run the engines on the germ oil with a reduction of 17 per cent consumption.

We shall not dwell upon the importance of conserving the world's supplies of fatty oils, which necessarily results from the replacement of large quantities of such fatty oils by small quantities of fatty acids. Though this is a great important matter of public interest, we shall at once pass on to the consideration of the more intimate question: what does the process mean to the oil man?

Our task is to estimate how the industry will be affected by two factors: one technological, one psychological. The first is the technological factor: namely, the demonstration of a new set of facts. In our previous remarks we have given the conclusions to which we were led by exhaustive research in the laboratory followed up by convincing measurements of frictional coefficients and confirmed by thorough trial for many months in commercial practice on the largest and most varied types of bearing surfaces. These conclusions are briefly:

(a) That 1 per cent of free fatty acid will lower the frictional coefficient of a pure mineral oil by 26 per cent.

(b) That although such "germ process" oils are only fractionally dearer than pure mineral oil, their value as lubricants is the same as, or better, than that of heavily compounded oils or straight fatty oils.

(c) That a logical reason has been given for the superior oiliness of compounded oils over mineral oils, namely, that the fatty acid present as impurity lowers the frictional coefficient.

(d) That there is no more danger of corrosion when using germ process oils containing limited amounts of fatty acids than when using compounded oils, and in many cases the danger is much less.

(e) In a word, these new facts may be summarized by saying that it is now possible to combine the oiliness of fatty oils with the cheapness of mineral oils.

The psychological factor is this: that the oil user has now found that one of his most cherished prejudices has gone by the board; namely, the old bogey of free fatty acidity. At the meeting in London large oil users were present. They admitted that the new process produced oil of superior friction-reducing properties and were in no way perturbed by the presence of a minute quantity of free fatty acid in controlled amount. The user is therefore now prepared to reconsider the whole question of specifications for lubricating oil and to revise his old standards.

These factors mean that the user has now recognized that the lubricating efficiency of pure mineral oil can be enhanced very greatly by the addition of quantities of fatty acids so minute that the difference in cost is inappreciable (only ½ per cent in money). This being so, the consumer will reflect that when he buys oil, he is buying reduction of friction, and will accordingly clamor for oils of high lubricating efficiency. In the past he could not afford such oils but now that they can be made at such low cost he will demand and producers will be forced to supply them. The user will insist on these oils, because they will reduce the friction on his bearing, after all the prime function of a lubricant, but also because with less friction he will find that: (1) his machinery will last longer, (2) his breakdowns will be fewer, as there will be fewer hot bearings, (3) and for the same reason he will use less oil.

*Eng. Pat. 130,677. U. S. A. Pat. 1,319,129 of 1919.

In some cases a saving of 15 per cent to 25 per cent of total oil can be effected by using better oil. The producer may not be impressed by economy in use of oil but when the user insists on these oils, the supply will have to be forthcoming. This demand for the new oils is already felt in England and it is bound to come all over the world, both because of their proved efficiency and for the psychological reason that users are beginning to look into the whole question of lubrication much more intensively and impartially.

This will help the refiner. He will now find that the user will listen to his views and will cooperate with him in using the lubricant best suited for its work. The refiner will now be in a position to modify the properties of his oils at will. If he wishes to reduce friction, he can do so. If he wishes to make an oil emulsify, he can do so. If he wishes to prevent an oil from emulsifying, he can do so. These modifications can all be made with minute quantities of substances which are cheap, universally soluble in all oils, and impart their beneficial effects between bearing surfaces of all metals so far investigated.

The producer will now be able to make cheaper mineral oils do the work of the more expensive ones, because he can rely less on high viscosity, and more on addition of fatty acid.

Indeed, he need not use fatty acid at all because petroleum itself, that wondrous museum of organic compounds, contains naturally the napthenic and other acids which we have proved to be effective also. This opens up new vistas in refining since the producer can utilize the natural acids of the oil or the sulphonic acids formed during the acid wash, either by leaving in a predetermined quantity, or by extracting all the acids and adding minute quantities of them to the oil in place of fatty acids.

It seems clear therefore that there are great economic possibilities in a process that yields oils which the consumer will insistently demand on account of their higher efficiency, certainty and economy, and achieves these results while facilitating the task of the refiner by enabling him to utilize cheaper products for higher-priced purposes, and securing geater control over the properties of the finished product.

Britain Requires "Made in U .S. A." Trade Mark

All exporters, and particularly automotive exporters, who have heard a great deal lately about trade marks, will be interested in the following despatch recently received by the Merchants' Association of New York:

"The American Chamber of Commerce in London is advised by its automobile section to remind American exporters not only of automobile accessories but in all lines of trade, that American trade marked articles coming into Great Britain must bear the words 'Made in U. S. A.,' or equivalent indication of the country of origin.

"This rule, the chamber desires to point out, does not apply to American goods alone, but to all foreign trade marked goods, and is one of the provisions of the Merchandise Marks Act of 1887, dating back to the reign of Queen Victoria.

"Trade marked articles not bearing indication of the country of origin being liable to seizure and confiscation, importers into Great Britain are being caused serious inconvenience, and in many cases actual losses by the failure of American manufacturers to comply with these regulations. What generally happens is that the importer is notified and warned the first time, but allowed to take away the goods, provided he stamps, stencils or otherwise marks them with the country of origin to the satisfaction of the customs authorities. Subsequent offenses however are likely to be punished by confiscation.

"British merchants who have been importing American trade marked articles for many years have of course straightened out these difficulties with their American shippers long ago, but the newer American exporters do not seem to have been properly informed. The American chamber is glad to know therefore that certain British importers have a reference to the foregoing provisions printed prominently on their order forms to the United States. As a means of making assurance doubly sure the American chamber recommends this practice to the attention of all British firms developing new American business with the United States."

Ford Official Says Price Revisions Have Been Granted

It was announced during the last week by an official of the purchasing department of the Ford Motor Co., Detroit, that not a single supplier of materials or parts manufacturer with whom the company is doing business has refused to cut existing contract prices. The official added that price reductions already recorded range from 10 to 20 per cent.

"I am not at liberty to reveal the names of concerns which have reduced their prices," said the Ford official. "Such a detailed statement might be construed as a breach of faith. I am willing to say however that every cut affects contracts that were signed months ago. Every big supply house and parts manufacturer with whom we do business has aligned itself with us in this movement to bring manufacturing conditions and costs back to normal.

"Losses must be accepted on present inventories. The firms with which we do business are willing to share such losses with us, because the ultimate goal is worth striving for. When the Ford company goes on the market for its 1921 materials and parts, and starts signing new contracts in January, I expect to see further declines. I expect to see material and parts prices down from 20 to 35 per cent by the first of the year."

Export Meeting of Automobile Manufacturers

Export managers of the National Automobile Chamber of Commerce held a convention at the New York offices, Marlin-Rockwell building, 366 Madison Ave., on Oct. 8.

As exports of automotive products already represent 8 percent of the entire United States export trade in completely manufactured articles, it is evident that the laws recently enacted to stimulate American foreign commerce will tend to increase this percentage still more. The convention tried to ascertain to what extent these new laws are facilitating export trade and discussed specific topics pertaining to foreign shipments of automobiles.

Philip B. Kennedy, who is vice president of the First Federal Banking Association, and formerly director of the Bureau of Foreign and Domestic Commerce, addressed the export managers on "How the 'Edge Bank' Can Co-operate With Automobile Manufacturers in Financing Exports."

Helpful Hints for Designers and Draftsmen

Proper Iron for Engine Cylinders

For years foundrymen have argued back and forth on the relative merits of soft or hard cast iron for cylinders. The advocates of soft iron claimed that the softer metal glazed over more quickly, and thus could be run in to produce a perfect cylinder surface more quickly. On the other hand, the advocates of hard metal, including those who favor a semi-steel, say that the soft metal is sure to be spongy, so that it will develop water jacket leaks and other troubles, even if the interior holes are not discovered in machining and testing. They claim also that while it will take longer to run the cylinders in with hard metal, that is, produce a glazed working surface, when produced this will last very much longer.

According to a recent writer in The Foundry, strong iron as hard as can be machined seems to give the best satisfaction in cylinders for gasoline engines. It must be strong since the engine has to be made as light as possible; it must be hard, and of fine close-grained iron, to withstand wear. The transverse breaking strain of the iron in these cylinders should be between 3,300 and 3,600 lbs. when the test is made on the American Foundrymen's Association standard arbitration bars.

Dry sand molds will give cleaner and smoother castings than green sand, but it is a more expensive method and is only used on the larger sizes of marine engines. If fine close sand could be used, the green sand would give just as smooth a skin; but unfortunately the very fineness of the sand interferes with the gas escaping from the mold. Mechanical analyses of molding sands indicate that the voids in fine sand are relatively larger than in that of coarser grades, but actual practice demonstrates the fact that the gases escape more readily through coarse sand, and therefore sounder castings are produced with this material.

The sands used for cores are usually lake or beach sand since a clean washed sand is one of the prime requisites of success on the jacket and smaller cores. The barrel core may be of different sand. Washed sand gives the best results. It is free from clay and other foreign matter which only tends to absorb binder. This sand contains nearly 90 per cent silica; therefore cores made of it resist the intense heat of the iron without fusing. There is no need of blacking, as they are easily cleaned out and leave a very smooth surface.

Oil binders are generally used on this class of work. When the proper proportions of oil and sand are used, a very strong open core is the result, requiring very little rodding. The venting is nearly automatic and the gas escapes very readily. Good results are obtained from a mixture consisting of one part of oil to 45 of beach sand. In order to obtain cores true to size it is advisable to use metal dryers.

Founders are aware of the wedging strain of iron and how it finds its way between two cores. It is very important that this should not take place in these cylinders. There must be an uninterrupted circulation of water around the barrel while the engine is running; therefore the two half cores for the jacket must be brought into intimate contact along the joint. To achieve this, a thin mixture of putty is applied to the joint of the core; or flour mixed with oil may be used. In some of the larger sizes a putty worm is laid between. On the still larger sizes the joint of the jacket core is usually filled with sand and dried with a torch.

Steel chaplets should not be used in engine work, as the salt water soon corrodes them and leaks develop. Copper rivets will prove satisfactory on light cylinders with thin walls. It is not necessary to make the stem of steel. Take a steel or iron rod and bore a hole in the end, in this insert the copper rivet or nail. If the iron is good and hot it will partly fuse the copper and make an absolutely tight joint.

Italian Government to Produce Aluminum

In view of the very large proportion of aluminum being used in all forms of automotive construction, and the fact that this is increasing rather than decreasing, it is interesting to note that the Italian government is understood to be making arrangements to purchase and work the large Abruzzi and Tamnium bauxite deposits. The probable intention is to manufacture aluminum wire to be used in place of copper in the electrification of the Italian railways. Italy's resources of bauxite are sufficiently large to permit production on a large scale. Other forms of aluminum than this wire will be made later.

Molybdenum in Crankshafts

In steel circles it is said that vanadium available for use as a purifier and alloying element is scarce and high in price, and that it probably will be more so. The attitude of the company governing the imports of this material is responsible for this. It is said that Britain has been practically deprived of all vanadium as a result of the new policy. The fact that a similar situation may be brought about here, due to the witholding of this metal from the market, leads to renewed consideration of molybdenum, which was used so successfully during the war.

One of the claims made for it was that it would replace vanadium and produce superior results. One of the uses for which it was tried with great success was crankshafts and other parts for Liberty engines. The crankshaft steel showed the following average composition and test results:

Carbon	Manganese	Silicon	Chromium	Nickel	Molybdenum
0.236—0.305	0.50—0.69	0.08—0.52	0.74—0 98	2.85—3.05	0.32—0.54

(on finished shaft)

Elastic Limit	Tensile Strength	Elongation, Per cent	Red of Area, Per cent	Izod Ft. Lb.	Brinell Hardness
130,000	142,000	20.5	65	67	303

This chrome-nickel molybdenum steel was made by the United Alloy Steel Corporation, Canton, Ohio, for Liberty motor crankshafts and connecting rods, under the jurisdiction of the Aircraft Production Department of the United States Government.

These results on the chrome-nickel molybdenum steel, obtained on test pieces taken from the finished crankshaft, are the more remarkable when it is borne in mind that a drawing temperature from 1,150 to 1,200 deg. F. is permissable. The high drawing temperature removes quenching and forging strains with the elimination of straightening operations during machining. Experience in making these finished Liberty motor shafts showed that the additional cost of the molybdenum was much more than offset by the savings brought about in the general shop practice. This is a matter of record.

Electro-Percussive Welding Promises Much

In a paper read at a meeting of the American Institute of Electrical Engineers recently, D. Miner described a new apparatus for welding metals on the percussion system. Percussion welding consists in fusing the ends of the sections to be joined by creating a spark discharge between them and almost simultaneously bringing them together in a percussive engagement. In the apparatus hitherto used the spark is obtained from an electrostatic condenser; hence it has only been possible to weld thin sections such as wire, as larger sections would require a condenser of prohibitive size. In the apparatus described by Mr. Miner electro-magnetic energy replaces electrostatic energy. The pieces of metal to be joined form the electrodes of the secondary circuit of a reactance coil. When the primary circuit of this coil is closed by a switch, an electro-magnet draws the electrodes into contact with one another, and the current in the secondary circuit excites another electro-magnet which draws the forging hammer into position ready to deliver its blow. The operating switch is then opened and the hammer magnet is thus de-energized. The hammer falls, and on its downward path operates a trip switch which throws open the primary circuit. The breaking of the primary current de-energizes the magnet holding the electrodes together and causes them to separate. At the same time the collapsing field in the primary circuit transfers energy to the secondary and an intense arc is formed between the electrodes, i.e., the pieces of metal to be welded. By the time the hammer has reached the end of its stroke and delivered its blow the metal is sufficiently melted to form a strong weld. The time taken for the whole operation is about one-tenth of a second, and the current consumed is only about one-sixteenth of that used in butt welding. In the experimental tests the work done included the welding of a one-quarter inch copper rod to a steel disc, a one-quarter inch steel rod to a steel disc, a five-sixteenth copper-copper weld, and a nickel-steel valve head welded to a cold rolled steel stem. All the results were satisfactory, a weld strength of 96,000 lb. per sq. in. being obtained for a steel-to-steel weld, and 40,000 lb. per sq. in. for copper to copper. Microphotographs confirmed the quality of the weld, and indicated interpenetration of the metals without visible alloying and a thorough fusion without oxidation

What Anhinga Is

This fiber, which occurs in Brazil, seems destined to play an important part in industry. Comparatively small quantities have thus far made their appearance, but the fiber is said to be suitable for the production of paper similar to that obtained from linen and to serve as a raw material for the production of a cotton-fiber substitute superior to cotton in some respects. A new process has been devised for the treatment of the fibers to make them suitable for textile purposes and at least one mill is reported to be producing something more than one thousand pounds of the treated fiber daily.

Data on Monel Metal, a Useful Alloy

A booklet on this alloy has recently been issued and gives a great deal of interesting data. That an ore, which might otherwise have presented a problem in refining, should have been found to yield a metal with so many important characteristics is fortunate, and constitutes another argument in favor of research and careful experimentation. Monel metal contains approximately 67 per cent of nickel, 28 per cent of copper and 5 per cent of other metals. It is tough and ductile, and can be machined, forged, soldered, brazed and welded. It has high tensile strength, resists corrosion and deoxidization, even in the presence of hot gases and superheated steam. As scientific data and results of practical experience are placed in the hands of engineers, a continually increasing variety of uses is found for this interesting alloy, and in some industries, such as dyeing, entire machines are now being constructed wholly of Monel metal.

Materials Handling Section Organized by A. S. M. E.

Four hundred members of The American Society of Mechanical Engineers have organized themselves into a professional section on Materials Handling and will provide primarily a common channel of intercourse between all the technical and industral organizations cooperall the technical and industrial organizations cooperwith the handling and distribution of materials and products.

Probably the greatest economic need of civilization today is the devising of means and a more intelligent application of proper and coordinated methods whereby materials of one kind or another may be handled more swiftly and to better advantage.

Industrial and railroad congestion has been almost intolerable and with these continued conditions have come mounting costs until better, more efficient and more adequate systems must come into being if the cost differential that is now being reflected in the soaring prices of all goods is to be modified.

The burden of this necessity made it imperative that a professional section composed of those whose interests and whose expert knowledge brings this problem close to them, should assume this work as its obligation to the technical fraternity and its contribution toward the solution of our national economic problem.

This section will aim to be a bureau of information—complete in its scope, specific in its knowledge of the physical and economic conditions and unbiassed in its conclusions. This will be done by having special meetings on particular subjects, meetings jointly with other sections, other organizations or associations, by taking part in all local and national problems relating to the purpose of this section.

A. S. M. E. Organizes Aeronautic Section

To the end of promoting in a large way the broad engineering development having to do with the future of aerial navigation regarded as an essentially international science, art and business, the members of The American Society of Mechanical Engineers interested in aeronautics have organized themselves into a professional section on this subject.

Howard E. Coffin, Jesse G. Vincent, Orville Wright, C. F. Kettering, Elmer A. Sperry, James Hartness, John R. Cautley, Lionel S. Marks, Miller R. Hutchinson, Charles E. Lucke and Joseph A. Steinmetz, all prominent in the aeronautic field during the war, are among those who have registered in the section.

The New and Unusual in the Automotive Field

G. B. C. Controller Protects Battery Against Overcharging—Temme Exhaust Heater Makes Cold Cars Comfortable—Memo Rust Remover Quick and Efficient

It will be the policy of Automotive Manufacturer (as in Automotive Engineering) to present on these pages each month some car, truck, aeroplane, boat, tractor, engine or other unit which presents unusual and decidedly different engineering features

G. B. C. Automatic Battery Controller

Recognizing as the whole industry does the need for some device to automatically protect the battery, generator and circuits against damage due to various causes, the Battery Appliance Corp., New York, has perfected the G. B. C. Controller shown in Figs. 1 and 2. This simple apparatus protects the entire electrical system of the car by automatically reducing the rate of charge to battery when overcharging begins; it automatically prevents overheating of the battery; it protects all circuits against overvoltage which might blow out the fuses and perhaps burn out a generator armature or field, and besides preventing and giving visible warning of these troubles, it indicates when the electrolyte level drops below a safe point.

As shown in the accompanying illustrations, this simple protecting device employs three auxiliary electrodes, which project through the ordinary cell caps so that the bottom of each electrode is just above the respective cell plate tops. Connections are provided from these electrodes to the dash instrument and connections from the latter to the generator. The dash instrument is essentially a combination of three electromagnets which operate three signals: one marked "low," another both "low" and "safe"; the third marked "off." This latter indicates whether the battery is being charged or not; the signal "off" indicates reduced generator output, while a blank space in the same window indicates normal charging.

Overcharging, the greatest battery evil, is prevented in a most simple way by appreciation of the fact that the condition becomes serious only when the battery heat has reached 110 deg. F. Therefore the controller protects the battery from overcharging by basically controlling the temperature.

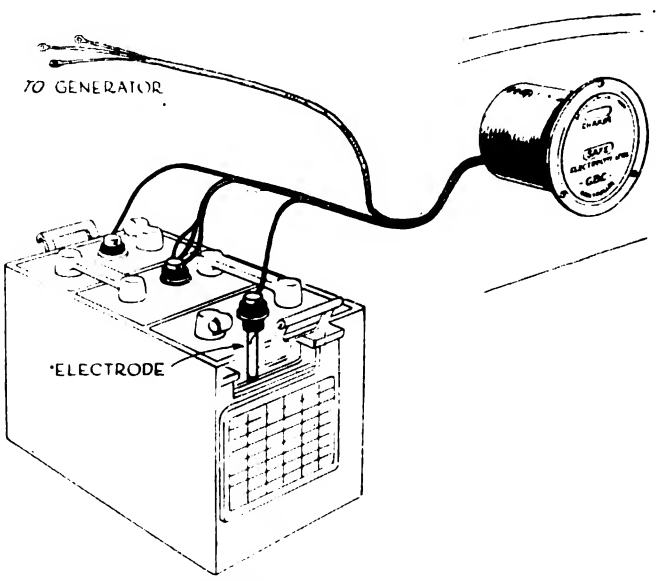

Fig. 1. General arrangement of battery system with G. B. C. Controller in use

The detail of operation is as follows: Three electrodes, one per cell, are connected by wires to the instrument on the dash. Safe level obtains as long as the electrodes are in contact with the electrolyte. If for any cause whatever the level in any cell of the battery falls out of contact with its electrode, the level indicator immediately flashes the sign "low" on the instrument dial and the driver at once knows the cells need water.

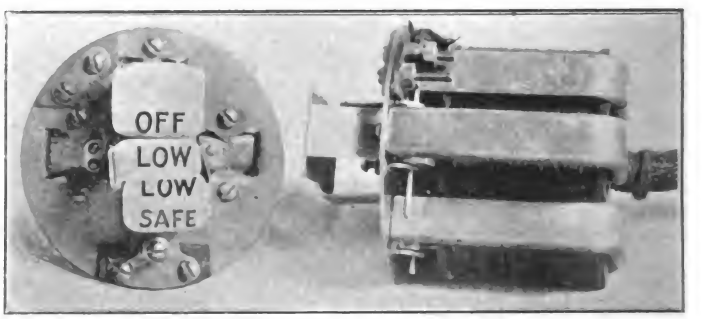

Fig. 3. Arrangement of Temme exhaust heater in car for cold weather use

The middle electrode is hollow and contains a small, rugged thermostat, adjusted to expand a specific amount when the battery attains a temperature of 110 deg. F. If the battery suffers the beginning of an objectionable overcharge, the temperature reaches this limit and immediately the action of the thermostat is conveyed by electrical leads to the instrument on the dash and it automatically changes the generator adjustment to reduce the charge, and thus compels the battery temperature to fall below 110 deg. F.

Should battery connections break loose or slowly corrode without the device, the generator voltage no longer is stabilized by the battery and it rises with increased car speed to values which may burn out the lamps, ignition coil and finally the generator itself. Fuse protection, if employed, saves the equipment but stalls the car. High voltage due to overcharge in the wintertime may also cause trouble. With the device no such danger exists. The controller has a coil in the instrument on the dash, which sensing this rising voltage or excess voltage due to any cause, immediately adjusts the generator output so that it can only develop the voltage needed for the lamps and ignition; thus protecting these auxiliaries and allowing the car to function.

Temme Exhaust Heater

Within the past year an automobile heater of the exhaust type has appeared on the market, which apparently

possesses considerable merit. Employing as it does pure waste gases manifestly it will find popular favor with the motorist who enjoys winter time motoring or who demands the maximum dividends from his investments.

This new improved heater by having three radiator coils scientifically constructed, possesses 98 fin-like leaves affording a heating capacity of 384 sq. in. which as guaranteed by its manufacturers, the Temme Spring Corp., Chicago, will comfortably heat the largest gasoline car built up to the present time. Other unique features of merit claimed for this device are: a control operated direct from the instrument board; a floor-plate flush fitting with the car floor; a clean-out door instantly accessible, thereby assuring sanitation at all times; an adjustable valve that in addition to offering the possibility of changing from one make and model car to another, is provided with a positive locking device which serves

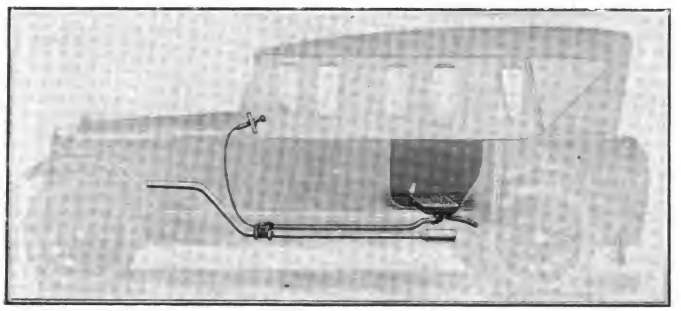

Fig. 2. Two views of the indicating element of the G. B. C. Battery Controller

as a complete choke-off when no heat is required. The radiator of one solid piece construction allows for no possibility of gas escapage into the car.

That this heater will have much to do with stimulating year-round motoring, and incidentally more than double the riding season is evident. Particularly will this device appeal to business houses who from actual experiment know an investment which pays a well worth while profit.

Memo Rust Remover

A new preparation known as "Memo" Rust Remover and Cleanser has recently made its appearance on the market, and it is one that bids fair to be a boon to all concerns and individuals engaged in or allied to any metal products industry, inasmuch as it appears to be a most important labor saving invention. The inventor of the preparation is a chemist of wide experience who, realizing that the methods employed to remove rust, corrosion, etc., from machines, engines, tools, parts and all metal surfaces, required considerable time and involved high labor costs, set before himself the task of devising a much better and more economical cleansing method, and devoted many years to unceasing research and experimentation with the result that "Memo" Rust Remover and Cleanser was invented.

That it is efficient to a high degree is proven by enthusiastic endorsements from those who have used it. The name "Memo" is derived from the Latin and means "less work." It is a scientific combination and blending of certain chemical ingredients, which in combination produces an electro-chemical action that rapidly loosens and dissolves rust, corrosion, grease, oil, dirt, carbon, paint or any other foreign substance that is adhering to the metal—irrespective of its age or hardness—and its action automatically ceases when contact between the cleanser and the metal is established, and this is as far as it will go, for it will positively not injure or mar the surface of the metal itself in any way.

There are two methods of using the preparation as follows: (1) Apply it to the machine or part with a brush and allow it to remain for a short time, then brush or rub it off and it leaves the metal bright and clean. (2) Mix the preparation in a vat, tank or container with water, then attach the machine or parts to wire or chain so that they will hang in the solution. No further attention is required since the process of cleaning goes on while the parts are immersed.

It is stated that the preparation is absolutely safe in every way and that it will not burn or explode. Another important point in its favor is that it will not cause corrosion or rust to form, for in fact, it protects the metal and makes it exempt from corrosive or disintegrating action for a long period after it has been treated by this preparation, and there need be no fear of injury to the most delicate part no matter what metal it is composed of. The preparation is an economical one to use as the same solution may be used many times over as it does not deteriorate or lose its cleansing power. Peter A. Frasse & Co., New York, are the sole distributors.

Transportation to Be Keynote of A. S. M. E. Meeting

At the forthcoming annual meeting of the American Society of Mechanical Engineers Dec. 7 to 10, the keynote session will be concerned with transportation. This will be discussed by authorities in the following phases: Railroads, motor trucks, waterways, feeders, N Y. terminal problems.

In addition there will be professional sessions concerned with fuels, machine shop, management, railroad, textile and power, and special sessions devoted to woodworking, research, design and miscellaneous matters.

A tentative program has been drawn up but more complete information will be available early in November. All sessions will be held in the Engineering Societies' Building, 29 West 39th street, New York.

Additional Notes of Body Builders

Schmidt & Storck Wagon Co., West Bend, Wis., manufacturer of heavy duty wagons, trailers, etc., will build a one story brick and concrete factory, 100 x 270 ft., costing about $90,000 with wood and metal working equipment, including forges, hammers, etc. Bids for the construction are being taken by Buemming & Guth, architects, 521 Jackson street, Milwaukee.

Phineas Jones & Co., 305 Market street, Newark, N. J., manufacturer of automobile and truck wheels, demountable rims, etc., has broken ground for the first unit of its proposed new plant at Liberty and Hillside avenues, Hillside. It will be a one story brick, and will give employment to about 200 persons. The company has seven acres of land at this location.

New York Auto Top & Supply Co., 260 Halsey street, Newark, N. J., manufacturer of automobile bodies, tops and other equipment has acquired property at 1168-70 Broad street, near Astor street, 63 x 118 ft., as a site for a new plant. Plans are being prepared by Backoff, Jones & Cook, architects, 9 Clinton street.

Standard Top Co., Walnut street and Wyoming avenue Scranton, Pa., manufacturer of automobile tops, has completed plans for a new one story plant, 40 x 100 ft., to cost about $10,000, exclusive of equipment. G. N. Edson, Connell Building, Scranton, is architect.

Stewart Body Building Co., Flint, Mich., has awarded a contract to the Realty Construction Co., Flint, Mich, for a new one and two story plant, 85 x 130 ft., for the manufacture of automobile bodies, estimated to cost about $100,000, including machinery.

Ideal Body Co., Madison, Wis., has been organized to manufacture open and closed passenger car bodies, truck bodies, cabs, etc. The building formerly occupied by the Fox Motor Sales Co., at Madison has been equipped for quantity production of bodies.

Bullwell Auto Body Co., 59 Jackson street, Brooklyn, has awarded a contract to Miller Brothers, 668 Saratoga avenue, for a new one story plant at Morgan avenue and Lombardi street, 100 x 100 ft., to cost about $25,000. B. Stillwell is president.

Current Automotive Metal and Supply Prices

General Conditions Business generally has been disturbed by recent price cutting of automobiles and trucks otherwise it is on the mend. Election is cutting less of a figure. Car supply movements are very much better. Call money is back to 6 per cent. Foreign buying holds up in quantity and is expected to for some months holds up in quantity and is expected to for some months by manufacturers, despite English coal strike.

Iron and Steel Ford and other automotive producers are beginning to press for lower iron and steel prices, with some success. The steel and iron men expect and concede lower levels, but are slow to yield ground. Unfilled orders are less, some mills and furnaces have shut down, and there is considerable unemployment. Valley irons are down $2.50-$3 from last month. Sheets of all kinds show big reductions. Steel bars in large lots can be placed at $3.25.

Copper and Aluminum Copper has recently dropped below 16 cents. and some metal is reported to have been sold at 15¼, both without bringing out any latent demand, so that producers, with fairly large stocks, are in a bad position. The present figures approximate present production costs, and it is doubtful if any metal available now was mined and smelted before labor costs went up, so any further downward movement (and it is possible) means an actual loss. Aluminum is unchanged with foreign metal quoted at 29 to 30c, N. Y., against a domestic price of 35c, which is shaded on large lots. Large buying before turn of year should reduce prices.

Lead and Tin Lead is very quiet with more metal offered than there are buyers for it. The leading interest quotes 7.75c N. Y., against foreign metal available duty paid at 7.59c. Early in October tin had a slight revival followed by a reduction to 41 cents for spot Straits. Later American buying in London increased prices there.

Zinc and Other Metals Recent buying of zinc has left light stocks and consequently prices are firm around 7.50c N. Y. This is said to have been shaded to 7.35c but producers claim the bottom has been reached. Demand for antimony is light, manganese is very quiet, quicksilver is down to $60 a flask, silver for export has reached 74c (on Oct. 19, 74 a 74¼), and other metals are either low or moving downward.

Other Materials Cotton, that is, raw cotton, has reached and gone below 18 cents for spot, in the past week. A reaction carried the price up to 19½c, but supplies are still very much in excess of demand. Southern planters are burning stocks in an attempt to increase prices. Yarns and woven goods show little of this marked reduction as yet, especially tire fabrics which have had very small reductions. Rubber seems to get worse each week, and up-river Para first quality can now be bought for 25 cents, with the possibility of approximating 24 on large quantities. Oil is unchanged with the single exception of dark lubricating. All fuel prices are stationary. Hides are weak with Bogotas quoted at 25c.

Every effort is made to have the following prevailing prices (compared with last month's) accurate but none is guaranteed. They are obtained through trade sources and may not be realized on small quantities:

	Sept. 13	Oct. 12
Acid, Sulphuric, 66°.....ton	$18.00 —20.00	$18.00—20.00
Alcohol, Ethyl, 97 p.c.....gal.	6.00 — 7.00	6.00— 7.00
Alcohol, denatured, 190 proof, gal.	1.05 — 1.10	1 05— 1.10
Aluminum No. 1 99% carloads.lb.	.35 — .38	.35
Ammonium Chloride (Sal-Ammoniac) white, granular....lb.	.17 — .18	.17— .18
Babbitt Metal, best grade.....lb.	.90	.90
Babbitt Metal, Commercial....lb.	.50	.50
Beeswax white .....lb.	——	.60— .65
Carnauba No. 1 Wax.....lb.	.90 — .95	.90— .95
Caustic Potash (85-92 p. c.)..lb.	.29 — .33	.29— .33
Caustic Soda, 76 p. c.....100 lb.	5.75 — 6.00	4.25— 4.50
Pumice, Ground (domestic)....lb.	.04 — .07	.04— .07
Shellac, Orange, superfine....lb.	1.40 — 1.45	1.10— 1.20
Tin, Metallic straits pig.....lb.	.45	.42
Turpentine, spirits of crude.....	1.49	1.20
Zinc, Western Spelter.....lb.	.10 — .11	.08
No. 9 base casks, open.....lb.	.15	.14

IRON AND STEEL, PIG, BARS, ALLOYS, OLD METAL

Pig, per ton—	Sept. 14	Oct. 12
No. 2 X, Philadelphia§.....	$53.51	$53.51
No. 2, Valley furnace†.....	50.00	47.00
Basic, delivered, eastern Pa.....	51.26	51.26
Basic, Valley furnace.....	48.50	46.00
Bessemer, Pittsburgh	50.46	50.46
Malleable, Valley	50.00	48.40
Refined iron bars, base price....	5.75c	5.50c
Soft Steel—		
¾ to 1⅞ in., round and square..	3 63—5.40c	3.48—4.75c
1 to 6 in. x ¼ and 5/16.....	3.73—5.40c	3.58—4.75c
Rods—⅝ and 11/16.....	3.68—5.45c	3.53—5.45c
Bands—1½ to 6 x 3/16 to No. 8..	4.33—7.00c	4.18—7.00c
Sheets		
Black, No. 28, Pittsburgh.....	7.50c	6.75c
Galvanized, No. 28, Pittsburgh..	9.00c	8.25c
Blue Annealed, 9 & 10.....	5.50c	5.00c
Tin Plate, 100 lb. box, Pittsburgh	$9.00	8.50c
Ferromanganese, 76% to 80% del.	$165.00—170.00	160.00—$170 00
Spiegel, 18% to 22% furnace, spot	80.00	80 00
Ferrosilicon, 50%, spot, delivered	75.00— 80.00	75.00— 80.00
Old Metal		
Heavy steel scrap, Pittsburgh...	28.50	28.00
Heavy steel scrap, Philadelphia..	26.50	23.00
No. 1 cast, Pittsburgh.....	42.00	40.00
No. 1 cast, Philadelphia.....	40.00	39 00

†Silicon, 1.75 to 2.25. §Silicon, 2.25 to 2.75.

BOLTS AND NUTS

(Discounts are from Nov. 1, 1919)	Sept. 14	Oct. 14
Machine bolts, c.p.c. and t. nuts, ⅝ x 4in.; Smaller and shorter..	10	30—10
Carriage bolts, ⅜ x 6 in.:		
Smaller and shorter, rolled threads	20	30—10 to 20
Cut threads	20	30 to 20
Semi-finished hex. nuts:		
⅝ in. and larger.....	40	50—10 to 40
9/16 in. and smaller.....	40	50—10 to 40
Tire bolts	50	50

BRASS, COPPER SHEETS, SHAPES, VIRGIN METAL, SCRAP

	Sept. 14	Oct. 12
Copper, Lake, ingot.....lb.	$0.19	$0.17
Copper, Electrolytic .....lb.	.186	.17
Copper, Casting .....lb.	.18½	.16¾
Copper sheets, hot rolled.....lb.	.33½	.29½
High brass wire and sheets....lb.	.30¼	.30¼
High brass rods.....lb.	.27	.27
Low brass wire and sheets....lb.	.28½	.28½
Low brass rods.....lb.	.29	.29
Seamless brass tubing.....lb.	.33	.33
Old Metal—		
Copper light and bottoms.....	.12½	.12
Brass, heavy	.09½	.07
Brass, light	.07	.06
No. 1 yellow brass turnings.....	.08¼	.07
No. 1 red brass or comp. turnings	.12½—.13½	.12
Aluminum, cast.....	.20—.20½	.19
Aluminum, sheet	.20—.20½	.19

CRUDE RUBBER

	Sept. 16	Oct. 20
Para, Upriver fine.....lb.	$ .28¼	$ .25
Upriver coarse .....lb.	.19½	.17
Upriver caucho ball.....lb.	.18½—.19	.17½—.18
Plantation, first latex crepe...lb.	.26	.25 —.25¼
Ribbed smoked sheets.....lb.	23½	.23 —.23¼
Brown crepe, thin, clean....lb.	23¾	.20

PETROLEUM PRODUCTS

	Sept. 16	Oct. 20
Oil—Pennsylvania Crude	$ 6.10	$6.10
Kansas and Oklahoma Crude..	3.50	3.50
Gasoline, Motor, garages, steel bbls..	.31	.31
Consumers, steel bbls.....	.33	.32
Lubricating Oil, black, 29 gravity	.28—.33	.29—.33
Cyl. light filtered.....	.90—.95	.90—.95
Dark filtered	.83—.85	.80— 83

MEN OF THE AUTOMOTIVE INDUSTRY

Who They Are What They Are What They Are Doing

Edward O. Goss has been elected president of the Scoville Mfg. Co., Waterbury, Conn., to fill the place made vacant by the resignation of Mark L. Sperry. Mr. Goss will also retain the general managership of the concern. Mr. Sperry has been associated with the company for fifty-eight years, and is now retiring entirely from active business affairs

George H. Mueller, formerly with the J. I. Case Plow Works Co., Racine, Wis., has become associated with the Termaat-Monahan Mfg. Co., Oshkosh, Wis., as vice president and general manager. During the war Mr. Mueller served as chief engineer of the Curtiss Aeroplane Motors Corp., which built the original Liberty motor under his supervision.

Arthur T. Murray, president of the American Bosch Magneto Corp., Springfield, Mass., has been elected president of Gray & Davis, Inc., Boston. This follows the arrangement recently made by the stockholders of the latter organization whereby the American Bosch Magneto Corp. assumes immediate executive control.

Otto L. Lewis, chief engineer of the Southern Motor Manufacturing Association, Houston, Texas, has resigned. Lewis has voiced his intention of remaining in Houston to develop a line of power farming machinery which is particularly adapted to the needs of the southern farmer.

Walter M. Lipps, who was formerly assistant general manager of the Victory Tractor Co., Greensburg, Ind., is now associated with the United Engineering Co., also of that city, and is located at its general sales office at 1607 Merchants Bank Building, Indianapolis.

Charles F. Willard, who was formerly chief engineer of the aeronautical department of the Aeromarine Plane & Motor Co., New York City, has become consulting engineer for Witteman-Lewis Aircraft Co., 140 West 58th street, also of that city.

Walter H. Barling has accepted a position as supervisory engineer for the Wittemann-Lewis Aircraft Co., Hasbrouck Heights, N. J. He was formerly aeronautical engineer in the engineering department, air service, McCook Field, Dayton, O.

J. D. Siddeley, managing director Armstrong-Siddeley Motors, Ltd., Coventry, England, manufacturer of the Armstrong-Siddeley car, is spending a month in the United States visiting automobile factories and studying problems of production.

G. J. Lang, vice president of the American Bosch Magneto Corp., Springfield, Mass., has been elected vice president and general manager of Gray & Davis, Inc., Boston. He will in the future divide his time between the two organizations.

Charles A. Trask has resigned as mechanical superintendent with the Rockwood Mfg. Co., Indianapolis, and has accepted a position as factory manager for the National Metal Products Co., which is located in the same city.

H. W. Christensen has accepted a position as production manager of the Highway Motors Co., Defiance, O. He was formerly chief draftsman in the truck engineering department of the Packard Motor Car Co., Detroit.

James F. Donahue, western sales manager of the Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y., has been appointed vice president and general manager of the Foster Bolt & Nut Mfg. Co., Cleveland.

H. Putnam Wood has accepted a position as general superintendent of the Universal Body Corp., Mishawaka, Ind. He was formerly in charge of mechanical body design with Brewster & Co., Long Island City, N. Y.

Alberto de Lavandeyro has been elected vice president of production of the Prado Automobile Co., 25 Church street, New York City. He was formerly consulting engineer for Bausch Machine Tool Co., Springfield, Mass.

A. A. Brevaire has been appointed chief maintenance engineer of Hare's Motors. Mr. Brevaire comes from the Pierce Arrow Motor Car Company where he was technical engineer for the service department.

John W. Dissette has been elected president and treasurer of the Sure Spark Ignition Corp., Washington. He was formerly chief of the aircraft section in the office of the Director of Sales, also in that City.

T. W. Morgan has resigned as president and general manager of the Lorain Motor Truck Co., Lorain, O., which was organized last November, and will be succeeded by M. J. Henninger, vice president.

E. V. Higbee has joined the production department of the Stanley Works, New Britain, Conn. He was formerly assistant research engineer with the Locomobile Co. of America, Bridgeport, Conn.

R. L. Johnson, formerly chief metallurgical engineer of the Exeter Machine Works, Pittston, Pa., has accepted a position with the American Non-Ferrous Metals Corp., 713 Crozer Building, Chester, Pa.

A. B. Webb has accepted a position as chief engineer of General Tractors, Inc., 675 Old Colony Building, Chicago. He was formerly chief engineer of the Monarch Tractor Co., Watertown, Wis.

Alexander Matheson has been elected vice president of the Motor Parts Co., Boston. He was formerly a member of the faculty of the Motor Transport Training School, Camp Holabird, Baltimore.

W. C. Rosenthal has accepted a position with the Aladdin Products Co., 312 North May Street, Chicago. He was formerly in the engineering department of the Packard Motor Car Co., Detroit.

Fred A. Bigelow has been promoted to the presidency of the Carpenter Steel Co., Reading, Pa., succeeding W. B. Kunhardt. The latter has been made chairman of the board of directors.

G. R. Petri has severed his connection with the Newport News Shipbuilding & Dry Dock Co., Newport News, Va., and has accepted a position with the Reynolds Truck Sales Co., Detroit.

F. W. Trabold has recently been made general sales manager of J. H. Williams & Co., Brooklyn, N. Y. He formerly held the office of vice president and general manager in the same company.

Fred A. Clock has resigned as chief engineer of the Watson Products Corp., Canastota, N. Y., to accept the position of chief engineer with the Capital Motors Corp., Fall River, Mass.

C. B. Lord, formerly general superintendent Wagner Electric & Mfg. Co., St. Louis, has become works manager of the Advance-Rumely Co., Battle Creek, Mich., agricultural implements.

G. W. Beyerle has accepted a position as engineer with the Wadsworth Sand Cutter Corp., 8610 Hough Avenue, Cleveland. He was formerly a consulting engineer at Independence, O.

H. L. Butterworth is no longer assistant in the experimental laboratory of the Nordyke & Marmon Co., Indianapolis, but is affiliated with the Alena Steam Products Co., also of that city.

William Wolfred has accepted the position of plant manager of the Rahmann Iron Works Co., Dayton, O. He was formerly works manager of the Pawling & Harnischfeger Co., Milwaukee.

John V. Schafer has accepted a position as engineer with Fairbanks, Morse & Co., Beloit, Wis. He was formerly assistant engineer with the Caskey-Dupree Mfg. Co., Marietta, O.

Joseph B. Cary has been elected vice president of the American Malleables Co., Lancaster, N. Y. He was formerly operating manager of the Air Reduction Sales Co., New York City.

Samuel W. Gray, who was formerly mechanical engineer with Reed & Glaser, Indianapolis, has accepted a position as production manager of the Acme Works, Inc., also of that city.

William Harrower, formerly chief engineer of the Collins Motors, Inc., Huntington, N. Y., has accepted a position with the Everlasting Valve Co., 65 Fisk Street, Jersey City, N. J.

H. F. Patterson has been appointed assistant chief engineer of the Supreme Motors Corp., Warren, O. He was formerly a designing engineer with the Rutenber Motor Co., Marion, Ind.

N. E. Hildedth has resigned as superintendent of the Cushmna Motor Works, Lincoln, Neb., to accept the position of works manager of the Witte Engine Works, Kansas City, Mo.

H. F. Peavey has resigned as assistant chief engineer of Stevens Duryea, Inc., Chicopee Falls, Mass., to associate himself with the American Bosch Magneto Corp., Springfield, Mass.

Alf C. Boock has severed his connection with the Pan Motor Co., St. Cloud, Minn., and accepted a position as layout draftsman with the Waterloo Gasoline Engine Co., Waterloo, Ia.

Everett Cavanaugh, who was formerly sales engineer with the Bimel Spoke & Auto Wheel Co., Portland, Ind., is now factory manager of the Imperial Wheel Co., Flint, Mich.

F. C. Goldsmith has resigned as chief engineer of the New Departure Mfg. Co., Bristol, Conn., and became affiliated with the Willys-Overland Corp., New York city on July 1.

Charles S. Dahlquist has resigned as chief engineer of the Timken-Detroit Axle Co., Detroit, to accept the position of director of engineering with the Eaton Axle Co., Cleveland.

W. H. Diefendorf has severed his connection with the Weekes-Hoffman Co., Syracuse, N. Y., and is now president and treasurer of the Diefendorf Gear Corp also of that city.

Henry M. Leland, president of the Lincoln Motor Co., Detroit, received the degree of doctor of engineering at the recent commencement of the University of Michigan.

Ralph H. Sherry has resigned as metallurgist of the General Motors Corp., Detroit, and has accepted the position of metallurgist for the Willys Corp., Elizabeth, N. J.

William S. Stockton has resigned as assistant chief engineer of the New Departure Mfg. Co., Bristol, Conn., to accept a position with the Willys Corp., Elizabeth, N. J.

Walter O. Lum, president of the Gould Motor Parts Co., York, Pa., has also been made general manager of the New Era Mfg. Co., 2033 Fifth Avenue, New York city.

Harry A. Oswald has accepted a position with the Hamilton Motors Co., Grand Haven, Mich. He was formerly chief engineer of the Quaker City Corp., Philadelphia.

H. L. Beckwith who resigned as service manager of the General Motor Truck Co., July 1, has been made general manager of the King Trailer Co., at Ann Arbor, Mich.

B. Russell Shaw, who was formerly general manager of the Aeronautical Instrument Co., New York city, is now connected with the Lawson Airplane Co., Milwaukee.

Clarence F. Jamison, formerly assistant general manager of the Elgin Motor Car Corp., Argo, Ill., has accepted a position with the Comet Automobile Co., Decatur, Ill.

George N. Duffy, formerly with the Curtiss Aeroplanes & Motors Ltd., Toronto, Ont., is now production engineer with the Willys-Overland, Ltd., West Toronto, Ont.

George L. Sexton, formerly connected with the Sexton Agricultural Tractor, Detroit, is now a designer with Sexton & Long, 56 bis Rue de Chateudun, Paris.

Charles G. King has returned from England and accepted the position of manager of the Miles Piston Ring Sales Co., 90 Mason Street, Milwaukee.

W. F. Pfander, formerly chief engineer of the Allen Motor Co., Fostoria, O., has accepted a position with the Chevrolet Motor Co., New York city.

Clarence M. Foss has received his discharge from the Army where he held the rank of major in the ordnance department at Washington.

Balfour Read, formerly of Marion, Ind., has accepted a position as assistant chief engineer of the Barley Motor Car Co., Kalamazoo, Mich.

Eugene M. Bournonville, who has devoted all of his time in recent years to the development of his rotary valve engine, has organized the Bournonville Rotary Valve Motor Co., a $300,000 New Jersey corporation having headquarters in Jersey City, N. J. where the inventor's home is. Bournonville will be recalled as the developer of the widely used oxy-acetylene cutting and welding system brought into existence b ythe Davis-Bournonville Co., and also as the introducer into this country of the compressed acetylene system generally known under the Prest-O-Lite name.

Howard Greene, M. E., a writer on motor topics, an inventor, and formerly on the editorial staff of several automobile magazines has been appointed editor of the department of animated mechanical drawings of the Harry Levey Service Corp. Mr. Greene was technical editor of Automobile Topics, technical editor of Motor World, and was on the editorial staff of The Automobile and Horseless Age. He was associated with the late H. F. Donaldson in starting The Commercial Vehicle, and is the author of a book entitled "Every Man's Guide to Motor Efficiency."

Guy P. Henry has been appointed chief engineer of the Studebaker Corp., South Bend, Ind., succeeding F. M Zeder, resigned. Henry has been connected with the Studebaker company for nine years in executive positions in the manufacturing and engineering departments, and is thoroughly familiar with the products and policies of the corporation. Vincent Link, the designer of the new Studebaker Light Six, remains with the corporation as consulting engineer with increased responsibility.

William A. Leonard of Chicago has been elected vice president and general manager of the Imperial Brass Mfg Co. of that city, makers of Imperial oxy-acetylene welding equipment and a general line of automobile accessories and brasswork. Until recently Leonard was associated with Belding Brothers & Company, of Chicago and New York as organization and sales promotion manager. This election completes hte sales organization.

C. W. McKinley, lately identified with the Willys-Overland Co., has been appointed sales engineer of the Tillotson Manufacturing Co, Toledo. McKinley's association with the Willys-Overland organization covers a period of many years, during which time he acted as chief designing engineer, consulting engineer at Washington on war work, and more recently as production engineer.

Harry A. Biggs has been appointed a director and vice president of the Studebaker Corp., in charge of domestic sales. E. H. McCarthy, his chief assistant as general sales manager, is made assistant to the vice president. L. J Ollier, director and vice president, will take charge of export sales. His assitant, H. S. Welch, is given the title of assistant to the vice president also.

Jackson H. Simms has resigned as vice president and general manager of the Simms Motor Car Corp, according to announcement by the board of directors. Other changes in the company's personnel are to be announced later, according to the board. Simms has sold his entire holdings in the company and is succeeded as vice president and general manager by H. L. Innes.

J. W. Peterson production and factory manager of the King Motor Car Co., Detroit, Mich., has resigned to join the Disteel Wheel division of the Detroit Steel Products Co. As Peterson's successor, the King company has chosen R G. Hendricks, who has spent five years in foreign lands working for the Rolls-Royce, Sunbeam, Isotta and Diesel car manufacturers.

John Tainsch, for the past four years sales manager of the Mitchell Motors Co., Racine, Wis., has been placed in executive charge of Mitchell sales by the company's board of directors. He thus takes up the complete control of the Mitchell selling department, succeeding in that branch of the work, R. C. Rueschaw, who has resigned as vice president of the company.

Lieut.-Col. C. M. DuPuy, president of the Pennsylvania Rubber Co., was unanimously elected chairman of the board of directors of the Chelsea Exchange Bank of New York City. Among the industry's prominent men making up the Chelsea Bank's directorate are John Willys, of the Willys-Overland Co., and W. W. Mountain, of the Mountain Varnish Co

Ralph C. Garland well known throughout the motor truck field, has become identified with the Wisconsin Parts Co. as chief engineer During the past four years Garland has been in the engineering department of the General Motors Corp., specializing on ball bearing applications in many lines of the automotive industry.

Frank W Ruggles comes into trade notice again as head of the Ruggles Truck Co., Alma, Mich., and London Ont., a company which he has recently formed. Ruggles was identified with the Republic Motor Truck Co. as president and general manager, and retired from that company several months ago.

Carl H. Peterson, superintendent of the axle division of the Olds Motor Works, Lansing, Mich., has severed his connection to become general superintendent of the Jackson Motors Corp., Jackson, Mich. Before going to the Oldsmobile plant, Peterson had been connected with the Locomobile and Studebaker companies.

E. S. Foljambe, well known in the trade publication field, has joined the forces of the Goodyear Tire & Rubber Co of California, at Los Angeles, as a special representative of the motor truck tire department. Foljambe's new duties will be along the line of educational speech making in "motorize the farm" campaigns.

Jules Haltenberger, for the last five years chief engineer of the Briscoe Motor Corp., Jackson, Mich., and designer of the new Briscoe model first shown at the New York show of 1920, has resigned. Haltenberger's resignation will take effect October 1. He has not yet disclosed the nature of his plans for the future.

Albert J. Romer, who developed the original designs of the Roamer and Murray motor cars, is now associated with the Northway Motors Corp., and is devoting his time to the designing and production of the chassis and bodies for the line of passenger cars which this Massachusetts company plans to produce.

J. G. Culbertson, president of the Wichita Motors Co., Wichita Falls, Texas has been nominated for governor by the Republicans of Texas. The platform adopted by the Republican party declares for the open shop. Culbertson is a member of the board of governors in the Southwestern Open-Shop Association.

Joseph Jandasek has been appointed chief engineer for Bollstrom Motors, Inc., St Louis, Mich. He was formerly tractor and truck engineer with the Paige Detroit Mortor Car Co. and was also connected with F. C. Austin Co., Chicago; Plano Tractor Co., and Laurin Klement, Prague, Czechoslovakia.

Ralph C. Chestnutt has resigned as designing engineer with the Bethlehem Motors Corp. He was formerly with the North American Motors Co., and came to Bethlehem when these companies merged. He designed the engines now used in Bethlehem trucks

R. H. Scott, general manager of the Reo Motor Car Co. Lansing, Mich., was elected president of the Novo Engine Co., recently Other officers are. C. E Bement, vice president and general manager; D. R. Hoadley, secretary; E. J. Bement, treasurer; E. P. Teel, general superintendent

Arthur H. Blanchard, professor of highway engineering and highway transport at the University of Michigan, will now lend his experience and knowledge to the road builders of that stae. He has recently been appointed consulting engineer to the Michigan State Highway Department.

George C. Hubbs has assumed the position of vice president and general manager of the Grant Motor Car Corp., Cleveland. For the past six years he had been connected with the Dodge Bros organization, and previous to that had been connected with the United States Tire Company.

W. B. Burgess, formerly of the Texas Motor Co., has joined the Southern Truck & Car Corp., Greensboro, N. C., as production manager. Since the organization of the Southern Truck company about two years ago, J. A. Norford, president, has been serving as production manager.

Finley R. Porter, recently resigned as chief engineer of the Curtiss Aeroplane Corp., and during the war who served as chief engineer at McCook Field, Dayton, O., has opened general engineering offices under the name of Finley R. Porter & Co., 56 Pine street, New York City

C. C. Hanch, until recently general manager of the Maxwell Motor Co., is expected by those in close touch with him to open offices in New York and Detroit at the head of an organization formed for consulting work on the general problems of automobile factory administration.

C C. Cox, until recently chief engineer of the Jackson Motor Corp., has joined the engineering staff of the Commonwealth Motors Co., Chicago, Ill. Cox will take entire charge of the designing and experimental work for the Commonwealth company.

T. B .Funk, who has been chief engineer of the Moline Co., Moline, Ill., and later founder and head of the Engineering Development Co. of the same city, has been appointed chief engineer, Utilitor Division, Midwest Engine Co., Indianapolis, Ind.

W. P. Chrysler and J. R. Harbeck, both identified with the Willys Corp. as vice presidents, have been formally elected directors of the U. S. Light & Heat Corp. Niagara Falls, N. Y., which company is included among the list of Willys enterprises

A. G. Bruswitz has been appointed president and manager of the Reliance Motor Truck Co., Appleton, Wis., with which company he has been a stockholder and director since its inception. Bruswitz was formerly county highway commissioner.

Alois Hauser has been made assistant to the works manager in charge of engineering of the Timken Roller Bearing Co., Canton, O. For several years past, Hauser has been efficiency engineer at the Saucon plant of the Bethlehem Steel Co.

P. L. Emerson, president and general manager of Jackson Motors Inc., the selling company of Jackson Motors Corp. (the manufacturing company), has resigned to give his complete time to the distributing companies which he controls.

H. F. Wardwell has been elected president of the Briscoe Motor Corp. Jackson, Mich., succeeding F. Cowin. Wardwell was formerly a railroad man, and for the past few years has been president of the Burnside Steel Co.

C R. Teaboldt, for the past four years with Gaston, Williams & Wigmore, New York City, first as assistant to the general manager of the automotive division, severed his connections with that company on September 1.

Joseph B. Armitage has joined the engineering department of the Kearney & Trecker Co., Milwaukee, Wis. Armitage resigned from the Aluminum Manufactures, Inc., with whom he held the post of mechanical engineer.

R. M. Graham has taken over the factory management of the Chillicothe Tire & Rubber Co., succeeding C. C. Cushman. Graham was formerly an efficiency engineer with the Goodrich company at Akron

Cory P. Green, who has been with General Motors Corp. and also in foreign automobile factories has been appointed chief engineer and factory superintendent, Jackson Motors Corp., Jackson, Mich.

Walter M. Jones, formerly with the Torbensen Axle Co., and also for many years identified with the Sheldon Axle Co., has been appointed chief engineer of the Indiana Truck Co. at Marion, Ind.

Donald S Michelsen, formerly general manager of the Worcester Pressed Steel Co., Worcester, Mass., has been made general manager of the Globe Machine & Stamping Co. Cleveland.

A. E. Borle, chaiman of the Savage Arms Corp., Sharon, Pa., has resigned from the directorate. It is reported that he has gone abroad for a stay of about six months.

Harry F. Lee, treasurer and general manager of the Morton-Simmons Hardware Co., Wichita, has been appointed receiver for the Jones Motor Co., Wichita, Kan.

Richard "Dick" Miles, for a number of years chief metallurgist of the Maxwell Motor Co., has resigned that post. He is returning to the Studebaker Corp.

A. G. Herreshoff has resigned as chief engineer of the Bethlehem Motors Corp., Allentown, Pa. Nothing definite has been revealed as to his plans

Charles A Cook, formerly chief engineer for the King Motor Car Co., Detroit, has accepted a position with the Haynes Automobile Co., Kokomo, Ind.

OBITUARY

William R. Innis of New York, formerly a director and an official of the Studebaker Corp., died suddenly Oct. 21. Mr. Innis retired from active business several years ago. He was 61 years old in 1884 he married a daughter of Peter Studebaker, and later became an important executive in the Studebaker firm. He also held a vice presidency and a directorship of the Chicago & South Bend Railroad. Business interests brought him to New York, and most of his time of recent years had been spent here. He was a director of the New York Life Insurance Company, of the O'Rourke Engineering Construction Company, and a trustee of the Union Dime Savings Bank.

ACTIVITIES OF AUTOMOTIVE MANUFACTURERS

Where They Are Located What They Are Doing How They Are Prospering

Frank B. Ansted, president of the Lexington Motor Company of Connersville, Ind., and his associates, United States Automotive Corporation, with an authorized capital of $10,000,000 of preferred stock, and 300,000 shares of no-par-value common stock, of which 100,000 shares are Class A and 200,000 shares Class B, has been organized. The new alliance includes in addition to the Lexington Motor Company, the Ansted Engineering Company, the Connersville Foundry Corporation and the Teetor-Hartley Motor Corporation. Frank B. Ansted is the president of the United States Automotive Corporation. George W. Ansted, also president of Ansted & Burk Milling Company at Springfield, O., is a vice president; Fred I. Barrows, also president of the Teetor-Hartley Motor Corporation at Hagerstown, Ind., is a vice president; and Emery Huston, also vice president of Lexington Motor Company, is a vice president. LeRoy A. Hanson, also secretary and treasurer of the Lexington Motor Company, is secretary and assistant treasurer. James M. Heron, also secretary and treasurer of the Rex Mfg. Company, is the treasurer. Directors of the company also include: William B. Ansted, president of the Central Manufacturing Company; John C. Moore, chief engineer of the Lexington; Charles C. Hull, president of the Rex Manufacturing Company; Arthur A. Ansted, president of the Indiana Lamp Company; Elmer J. Hess, former president of the Western Spring & Axle Company and a capitalist of Cincinnati, O., and O. A. Eberhart, former governor of Minnesota and general counsel of H. W. Dubiske & Company, Chicago.

W-S-M Tractor Corporation, Akron, O., has acquired a 20 acre site southwest of Akron, on the Akron, Canton & Youngstown Railroad and on the Akron Belt Line, and arrangements have been completed for acquiring 91 additional acres. The first unit will be erected shortly, at a cost of $250,000, and machinery and accessories will be installed amounting to approximately $200,000. The corporation is affiliated with the Wellman-Seaver-Morgan Co., Cleveland, which has been conducting experimental work on farm tractors for some time. Edwin S. Church, president Wellman-Seaver-Morgan Co., is also president of the tractor corporation, and for a number of years was associated with the International Harvester Co.

Kennedy Corporation, Baltimore, recently incorporated with $2,000,000 capital stock, and of which Joseph P. Kennedy is head, has bought the plant of Fairbanks, Morse & Co., and also the entire capital stock of the Baltimore Malleable Iron & Steel Casting Co., the price for both being $1,850,000. The Kennedy Corporation was formed to specialize in automobile agricultural tractors and railroad castings and the two additional plants adjoin its property. It was recently stated that the Baltimore Malleable Iron & Steel Casting Co. planned extensions and the installation of equipment which would double its capacity.

Nash Mtors Co., Kenosha, Wis., has engaged in regular production in its new works on Clement avenue, Milwaukee, of which B. W. Twyman is general manager. The force numbers 1,000, which will be increased to 2,000 by Jan. 1 to make possible a first year's prduction of 10,000 four cylinder Nash passenger cars. Most of the equipment has been purchased and installed but additional tools are being contracted for from time to time. G. E. Bechtel is works manager.

DuPont Motors Co., Commerce and Dock streets, South Wilmington, Del., will commence operations at once in its new plant at Moore, Pa. It will be used for the most part for assembling work, and it is proposed to develop an output of about 150 automobiles per month. The South Wilmington plant will be operated for the present for the manufacture of motors, and body production will be conducted at a plant in Philadelphia.

American-La France Co., Elmira, N. Y., manufacturer of motor driven fire equipment, has increased its capital from $4,950,000 to $5,950,000. It is operating at capacity and is said to have orders on hand to continue maximum production for the next five months. Contract was recently let to the Foundation Co., New York, for a new plant at Bloomfield, N. J., to manufacture motor trucks, and construction has begun.

Thomart Motor Co., Akron, O, has been formed to build the Akron Speedwagon designed to carry truck loads at high speeds. The company takes its name from the first and last parts of the names of W. G. Thompson, president, and J. L. Stewart, vice president and general manager, both of whom have been with the International Harvester Corp. in its automobile division.

Foster Motor Car & Mfg. Co., Ltd., has recently been formed to manufacture the Foster motor car, to be equipped with the Herschell-Spillman motor. A site has been secured in the east end of Montreal, where a plant will be established. The head office will be at First avenue and Ernest street. Captain M. L. Fitzgerald will be in charge of the company.

Peters Motor Corporation, Trenton, N. J., recently organized, is planning for the establishment of a local plant for the manufacture of a popular priced automobile. A site is now being selected and details of the project are being arranged. Preliminary work has been conducted at the factory of Fitzgibbon & Crisp, Inc., Calhoun and Durnham streets.

Menominee Motor Truck Co., Clintonville, Wis., has completed its new works and the transfer of its equipment from the former plant at Menominee, Mich., and is operating at the rate of 50 trucks per month, which will be increased to 100 by May 1, 1921. The output to Jan. 1 has been sold. Practically all equipment has been provided. James A. Bell is vice president and general manager.

Dort Motor Company's $3,500,000 motor transmission and machining plant occupying a 77 acre site east of Flint will be completed by the middle of November. The plant which has been under construction for several months will be operated by direct motor driven appliances and will give employment to approximately 1,000 men.

Fageol Motors Co. of Ohio, Cleveland, has been incorporated to build Fageol trucks, tractors and pleasure cars in the east. F. R. Fageol, founder of the parent western company, is president of the new concern which has leased the building formerly occupied by the National Bronze & Aluminum Co., containing 25,000 sq. ft.

Trego Automobile Co. have been investigating sites of two and three acres with railroad sidings for a plant in the vicinity of New Haven, Conn. Nothing definite has been decided and no engineer has been selected for the work. Temporary quarters have been established in the Liberty Building, New Haven.

Research Engineering Co., Dayton, O., has been formed to manufacture a moderate priced air cooled automobile, named the Spencer after its designer, O. H. Spencer. It is said to include a new type of transmission and springing, the latter including four full cantilever springs. Mr. Spencer is president.

Steinmetz Electric Motor Car Corporation, Baltimore, which recently acquired property on Kate avenue, fronting on the Western Maryland Railroad, Arlington, for the manufacture of electrically operated motor trucks, s enlarging its plant to include the manufacture of gas operated tractors.

Bethlehem Motors Corp., Allentown, Pa., manufacturers of trucks, are preparing to turn out a light passenger car for the English market in quantities. Arthur T. Murray of the company is said to have accepted an order while in England for 10,000 of these.

Stockton Tractor Co., Stockton, Cal., is having plans prepared by Frederick S. Harrison, architect, People's Bank Building, Sacramento, Cal., for the erection of a new one story brick and concrete plant at West Sacramento to cost about $75,000.

William Small Co., Indianapolis, Ind., is now in the hands of receivers, asked for by the management of the company. Liabilities are estimated at $900,000 and assets at half that amount. The Monroe automobile was the product.

Vim Motor Truck Co., Twenty-third and Market streets, Philadelphia, has awarded a cntract to the Truscon Steel Co., Commonwealth Building, for four new machine shops at Fox street and Roberts avenue, to cost about $48,000.

Ford Motor Co., Detroit, is considering the establishment of a new factory branch at Williamsport, Pa., to be equipped for assembling and other features. The proposed works will be used for service throughout this district.

Pioneer Truck Co., Valparaiso, Ind., is contemplating the erection of a new one story plant for the manufacture of automobile trucks 100 x 300 ft., to cost about $100,000 including equipment. O. M. Frier is president.

Haverford Cycle Co., Los Angeles, has been incorporated with a capital of $50,000 by Samuel Redmond, Samuel Eidelson and Hubert Starr, 309 Stimson Building, to manufacture motorcycles, bicycles and parts.

Ford Motor Car Co., Detroit, is taking bids for its new one story assembling plant, 175 x 535 ft., at Tenth and Winchester streets, Kansas City, Mo., estimated to cost in excess of $350,000, including equipment.

Lafayette Tractor & Machinery Co., Lafayette, Ind., has been incorporated with $100,000 capital stock to manufacture tractors. The directors are Floyd A. Loop, Larry B. Harris and Abner E. Werkhoff.

Mutual Truck Co., Sullivan, Ind., manufacturer of motor trucks, has awarded contract to the M. J. Hoffman Construction Co., Evansville, Ind., for a two story building, 80 x 100 ft., to cost about $75,000.

A. C. Motor Truck Co., Rochelle Park, N. J., has been incorporated with capital of $50,000 by C. S. Bentley, William J. Aitken and H. C. Chambers, Rochelle Park, to manufacture motor trucks and parts.

Parts Makers

Hartford Automobile Parts Co., Hartford, Conn., has acquired the Acme Universal Joint Mfg. Co., Kalamazoo, Mich., which has been in operation about 10 years and employs about 300. It will hereafter be known as Plant K, and E. L. Pollock, Jr., assistant treasurer will represent the home office at Kalamazoo. Most of the heavy work will be done in the Hartford plant, while assembling and lighter work will be carried on at Kalamazoo. The company is placing on the market a new hydraulic compensation clutch which is a rotary shock absorber installed on the propeller shaft that absorbs all starting shocks.

Universal Products Company, Sandusky, O., and Oshkosh, Wis., has increased its capital to $500,000. The plans include the purchase of the H. C. Doman Company of Oshkosh, Wis., and the removal of the main offices from Sandusky to Oshkosh. The new company will continue to manufacture the Universal Products electric lighting and power plant and the Doman marine engines. Officers are L. E. Willson, president; R. K. Schriber, vice president; Charles H. Eichinger, secretary, and Louis Schriber, treasurer.

Vacuum Muffler Corp. of America is moving the offices and factory to the new building, 220 Fifth street, Bridgeport, Conn., and on and after Thursday, October 14 can be reached at that address.

Auto Glass & Mirror Co., Jefferson and Superior streets, Buffalo has filed application to operate a works in a two story building, 60 x 120 ft., previously occupied by the Buffalo Engine Co. The equipment will comprise grinding machines, smoothing machines and polishing machinery, all electrically operated. Joseph N. Steenmans is president.

Morse Chain Co., Ithaca, N. Y., has opened a branch factory at the corner of Eighth and Abbott streets, Detroit, which will be devoted exclusively to the manufacture of Morse automobile silent chain sprockets and the Morse adjustment. Its sales and engineering offices have been removed from 1003 Woodward avenue to the new factory.

Cheboygan Metal Products Co., Cheboygan, Mich., recently organized, has bought a warehouse and is having the structure remodeled. The machinery and equipment is ready to be installed. Among the products to be manufactured are spark plug testers, for which the company is said to have orders for several thousand.

Simms Magneto Co., North Arlington avenue, East Orange, N. J., manufacturer of magnetos and ignition equipment for automobile service, called a special meeting of stockholders on Nov. 30 to approve an increase in capital from $1,500,000 to $2,000,000. It is also proposed to arrange for a bond issue of $500,000.

Hexmen Motor Co., Racine, Wis., organized a year ago to manufacture a patented device for internal combustion engines, has changed its name to the Ames Carburetor Co., and will enlarge its production to include carburetors and auxiliary appliances. Fred C. Haumerson is secretary and general manager.

Fordlette Engine Co., Huntington, W. Va., recently organized with a capital of $100,000 to manufacture gas and gasoline engines is planning for the erection of new one story works, 50 x 150 ft., with machine shop department estimated to cost about $25,000. H. L. Grimm is secretary and treasurer.

Gold Seal Storage Battery Co., Green Bay, Wis., has been incorporated with a capital stock of $300,000 and will build a plant early next year for the manufacture of accumulators. The incorportors are F. J. Mankin, E. J. Bolza and T. J. Best. Details of the project have not been given out.

WANTS

Situation Wanted.—Successful executive with extensive experience in all phases of Passenger Body Manufacture desires a permanent connection where his ability as organizer and producer will find a reward commensurate with his efforts. Address Producer, care The Automotive Manufacturer, 25 Elm street, New York.

PATENTS

Patents—H. W. T. Jenner, patent attorney and mechanical expert, 622 F St., Washington, D. C. Established 1883. I make an examination and report if a patent can be had and exactly what it will cost. Send for circular.

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The Automotive Manufacturer

The Hub of Automotive Engineering

BODY BUILDING - AUTOMOTIVE PARTS - ALLIED INDUSTRIES

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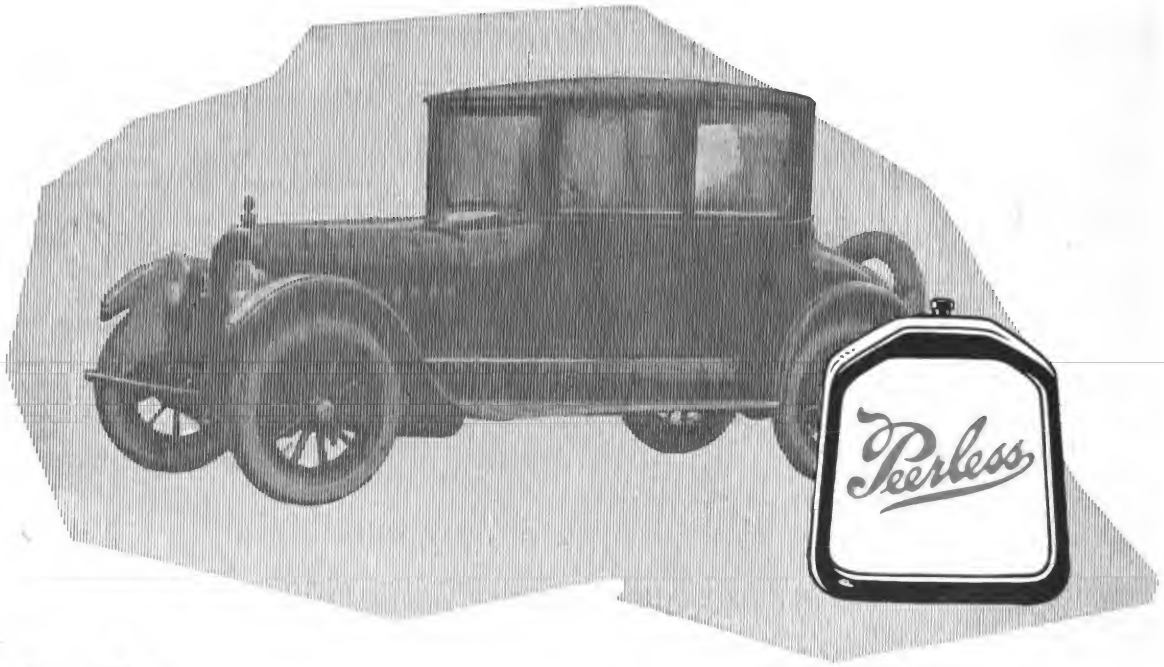

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Vol. LXII NEW YORK, FEBRUARY, 1921 No. 11

Chicago Concludes National Shows With Success

Great Western Display Has Large Attendance and Record of Much Business Done—Sales Stimulated All Over Country—Plant Closing and Output Restriction Brings Widespread Talk of Forthcoming Shortage of Cars and Trucks

SUBSEQUENT to the closing of the very successful and business-stimulating New York National Automobile Show and Highway Transportation display, as chronicled in the January issue, the Chicago National Show has opened, run its full week and closed with a record of even greater success. It may be that the big eastern display paved the way since it provided a level from which the western show started upwards. It may be that the relatively smaller amount of territory which the first show serves as compared with the vast middle west which the later Chicago exhibition serves, had much to do with it; it may even be that the growing spirit of optimism had raised the spirits of the business men of the country a considerable distance between the closing of the one and the opening of the other; at any rate, the Chicago show was unusually successful and remarkably satisfying to its backers and exhibitors.

New York showed that the buyers were coming back into the market, slowly it is true, but certainly coming back. Chicago proved it. Actual retail sales at the latter were but two-thirds of last year, but it must be remembered that prior to it, no business in automotive vehicles had been done in Chicago and vicinity for more than two months. In this comparison also, it must be remembered that last year's was the record display. The paid attendance, despite a number of rainy and otherwise disagreeable days, was 16 to 20 per cent greater than last year. From this greater attendance, which makes a new record for Chicago, the orders mentioned above were received, in addition to which every exhibitor compiled a splendid list of prospects, most of them for the very near future. This was shown clearly in the case of the New York Buick branch, which subsequent to the show there obtained from its prospect list sales which covered the entire March deliveries and practically 75 per cent of the April deliveries. In fact, at this writing the entire April allotment for that branch has been sold. This gives an indication of what may happen, is happening now, in the Chicago territory as a result of the show. So far has this matter of advance sales proceeded that the Ford company is to open its big Detroit plant to full time operations on March first, and several of the smaller factories, as for instance Lexington, Nash and others, have already done so.

Based on the similar results in the smaller and purely local shows which have followed the big national displays at New York and Chicago, dealers all over the country are beginning to say that the sales will outrun the factory production plans. This was markedly so at the Buffalo show, at which practically every leader of note, representing practically all the well known makes of cars, predicted a shortage in the spring.

All over the country, the industry is showing greater optimism, and is very busily engaged in hustling for the business which it now knows is to be had. This is as it should be, for the industry has generally been the business leader, and it must be admitted that generally business has not yet shown the upward trend which was expected. Many are predicting a marked and very rapid upward turn beginning March 5. While such a development would be entirely psychological, inasmuch as a new administration could not by any possibility make its influence upon business felt for a number of months, this doctrine seems to be so widespread and so thoroughly believed that it must bring some improvement of itself.

In a general way, business is much better than a month ago, and vastly better than two months ago. Deflation in the iron and steel industries has not yet run its course, nor has there been any in transportation. The influence of these two upon general business is tremendous, but the desired changes are proceeding in an orderly but slow manner. For the present, the leading interest in the steel and iron industry is blocking further downward revision because of large unfilled orders on which the loss would be tremendous, but all signs point to a change in that attitude within two months.

To return to the New York show, not completely described in the previous issue, it brought out remarkably

The latest undertaking is to mechanically gather the gum from the peat, or pukau, which is really the damaged kauri gum in the low or swampy land found in the territory around Auckland. This is to be worked by what is known as the sluice process, similar to sluicing for gold. The peat is placed on a screen and water forced through it. The screen gathers the chip gum and allows the waste or tailings to drop beneath. This chipped gum is divided into about 15 per cent first quality, 15 per cent second quality, and 70 per cent low grade. The tailings are converted into kauri-gum oil in a manner similar to extracting oil from shale. It is estimated that 40 to 50 gallons of kauri gum oil can be taken from a cubic yard of pukau. This oil is a very valuable commercial oil, containing a large percentage of motor spirit and turpentine.

It is stated that one company in Auckland has control of kauri gum rights covering 47,000 acres, estimated to contain 13,000,000 cubic yards of pukau In adition, the New Zealand government still holds gauri gum reservations that are estimated to contain an even larger quantity of pukau, to say nothing of many private interests holding small sections of kauri swamps. This will give some idea of the real size of the industry that means so much to the paint and varnish interests of the United States, as well as to the linoleum and rubber manufacturers.

Claims on Government Reservations

The New Zealand government is allowing persons to stake out tracts or claims of 3 acres on the government reservations for which the individual operators must pay 10 per cent of the value of the gum taken from these swamps. It is said that a large number of claims are being staked out.

In addition to the gum and oil that can be extracted from the pukau there are large numbers of buried kauri trees, from which very large quantities of oil can very easily be extracted by a process similar to that used in extracting turpentine from pine logs.

The first plant in New Zealand for the extraction of oil from kauri gum peat, or "pukau" (which is part of the soil of the buried kauri forest saturated with the oil of the kauri), has commenced operation at Redhill. The plant is built to turn out 4,500 gallons of oil per week, its fractions being motor spirit, a valuable solvent oil, a turpentine substitute, and paint and varnish oils. The process of extracting the oil is very similar to distilling oil from shale. The cost of distillation is about the same, but the digging of the pukau from the swamp is infinitely cheaper than working a shale deposit, as pukau generally runs in layers 4 feet thick, having only 1 foot of overearth.

At present pukau is sieved by hand; the small pieces of gum (known as nuts, chips and seed gum) are saved and oil is extracted from the residue. A new machine will soon be installed for sieving the pukau and washing the gum, thus saving a great amount of labor. This will be a subsidiary branch of the oil works.

In the swamps large quantities of oil soaked timber are found, which later will likewise be treated for oil. It is claimed that the bark, limbs and roots of the kauri tree are capable of yielding 110 gallons per ton, richer than the pukau itself, and it is estimated that the best swamps carry 500 tons of this oil soaked timber.

The supporters of this Redhill plant claim that the extracting of oil from pukau will become the most important industry in New Zealand, since there are thousands of acres of this swamp land in the North Auckland province, and each contains many thousands of dollars' worth of oil.

Large deposits of kauri gum in New Zealand which have hitherto been known hardly more than locally, have been reported. The deposits are in the swamp areas in the extreme northern tip of the North Island, not many miles from Auckland, the capital. Small local efforts have been made to extract from the deposits their valuable ingredients, but as yet no effort has been made to work them on a large scale.

Kauri gum, as is well known, is the sap of the large trees of the pine family which abound in New Zealand. It is useful in the manufacture of varnishes, paint, oils and turpentine, and is worth at the present time about a thousand dollars the ton. Ordinarily of course the gum is obtained either through extraction of the distillation of the wood in which it comes. The great industrial value of the wood itself, and the extracting expense make the gum costly.

The remarkable part of the present discovery consists therefore in the fact that the gum is found in loose particles in the peaty soil which makes up the great stretches of swamp in North Island. Excavations in the swamp have established the fact that there is, submerged under its water-soaked surface, a great forest of kauri trees. The Maoris of the regions have no tradition of a forest of this kind having existed in this part of the island, and so it must have grown many thousands of years ago, and have been submerged as a result of some severe seismic disturbance. Yet the timbers taken out by the prospectors proved to be in perfect condition, and were sent to a local sawmill and worked into lumber. One of the logs so recovered, according to photographs, was at least thirteen feet in diameter.

The small local group which is attempting to capitalize the discovery has started a small sawmill near Dargaville, which is the largest town in the immediate vicinity. They excavate and retort the peaty soil, and according to the statement of one the directors, have obtained up to seventy gallons of crude oil to the ton. Analysis of this oil shows it to be made up of about 15 per cent motor spirit, 15 per cent solvent oil, 30 per cent paint oil and 30 per cent varnishes, balance pitch.

It it asserted that a few miles of pipe line would take the product to any of the small harbors along the coast.

Production of Kauri Gum

The production of kauri gum during the seven years previous to the beginning of the war averaged not far from 8,000 tons per year, while since that time it has scarcely averaged 4,000 tons, and during the year ended March 31, 1919, only amounted to 2,338 tons. Of the output of 8,473 tons for 1914 the United States took 4,531 tons, the United Kingdom 3,335 tons, Germany 373 tons, and the remainder was well scattered over 10 other countries; while for the year ended March 31, 1919, the United States took 1,371 tons of the 2,338 tons.

Other Resins and Asphaltum

Damar resin is probably very familiar to many, having been used for years in the manufacture of this varnish. Its one important feature is its color, and that is about all we can say for it. It has no durability, is very soft,

and has a very low melting point so that it cannot be used in any of our high grade varnishes. You may recall that formerly all the enamels on the market were made by the use of a damar resin; today it has been abandoned by the manufacturers of the highest grade of white enamels on account of its being lacking in durability. However for many of the cheaper enamels it is still being used to a very considerable extent on account of its whiteness.

Asphaltum is not really a resin, being a cross between solft coal and petroleum and comes to us largely at the present time from Utah. This bituminous material is used in the manufacture of our black air drying and baking japans, being used largely upon iron work.

Years ago the people who supplied the gums were criminals, vagabonds and people who had drifted into New Zealand from all parts of the world. They would start in the morning with their prodding sticks and knapsacks on their backs and by the use of their sticks determine at what places gum could be found, would then proceed to dig up same, gathering only the gum found on the surface. In the evening they could be seen around the camp fire scraping their gum and preparing it for the market. In this connection also we should say that the Maoris, or the natives of New Zealand, also gathered considerable quantities of the gum, and one could see the Maories with their families out upon the field, it making very little difference whether a large or small amount was gathered.

Today however the gum digger is more like our modern miner. He starts off with his various prospecting sticks, his spade and coarse tooth saw, with which he saws around the roots and moss in order to unearth the gum. The surface of the earth is then dug up and the gum and dirt thrown to one side. This digging goes on until the gum diggers have proceeded to a depth of 20 feet below the surface of the earth in their search for gum. The gum is then thrown upon a screen, where it is washed and the earth and other decayed matter is separated from it. It is then all scraped and sorted, and carried down to a general warehouse where it is further sorted. The gum is then taken to the broker's warehouse where it again is sorted by men who have had wide experience in that work. The men start as mere boys, first working on the cheaper gum and then they are gradually promoted to work on the higher grades of gum; this is very important work when we realize the variations in its price. The gum is then put into bins, and from the bins is packed in cases and shipped to foreign ports.

Passing from the subject of gums to that of oils, the first is of coure linseed oil, which is made from the flaxseed grown in Canada, United States, Argentina, India and around the Baltic sea. It is very curious to note that the oil from these various parts of the world differ so much due probably to climatic conditions, and also to methods of harvesting.

In all of these countries the manner of harvesting the flax is very similar, the modern harvesting machine being used, following which the flaxseed is separated from the flax stock by means of a modern threshing machine and is then ready for the market. The seed is then carried to various lake ports and comes down to the lakes in large grain boats. It is then conveyed from the boats to grain elevators and is separated according to the various grades and the source from which it comes. Then it is carried by means of large conveyors to the rolls. These consist of large corrugated rolls of steel between which the seeds pass until they are crushed into fine powder. This powder is emptied into the tempering kettle on the floor below, where a certain amount of moisture and heat is applied by means of steam, the proper amount of moisture and the correct temperature being judged by the hand of the workman who is very expert at this particular trade When the powdered flaxseed is in proper condition the seed passes out under the "former" between two camelhair mats. It is then placed in the presses, the mats being one above the other, and when the press is entirely set up hydraulic pressure forces the mats together, pressing the oil from the seed.

The material left in the press is the linseed oil cake, and all the surplus oil is found at the edge of the cake. The cake consequently is passed through a trimming machine which takes off this "edge" and the cake is then baled up ready for shipment and the trimmings are sent back to go through the process again. This cake is used largely for cattle feed.

The oil is then filtered by filtering presses, passing through cloths, and the oil is now ready to be filled into the barrels. Thus we have our raw linseed oil. The oil at this point however is not in proper condition for use by the varnish maker on account of the fact that when heated to a temperature of about 450 deg. F., muscilagenous material otherwise known as the "break" separates from the oil. Consequently it is necessary that the linseed oil manufacturer further refine his oil, which is done by means of various chemicals and mechanical devices in order to produce an oil which will meet conditions imposed by their consumers. At this point also the various driers are added to the oils in order to prepare the boiled oils found upon the market.

China Wood or Tung Oil

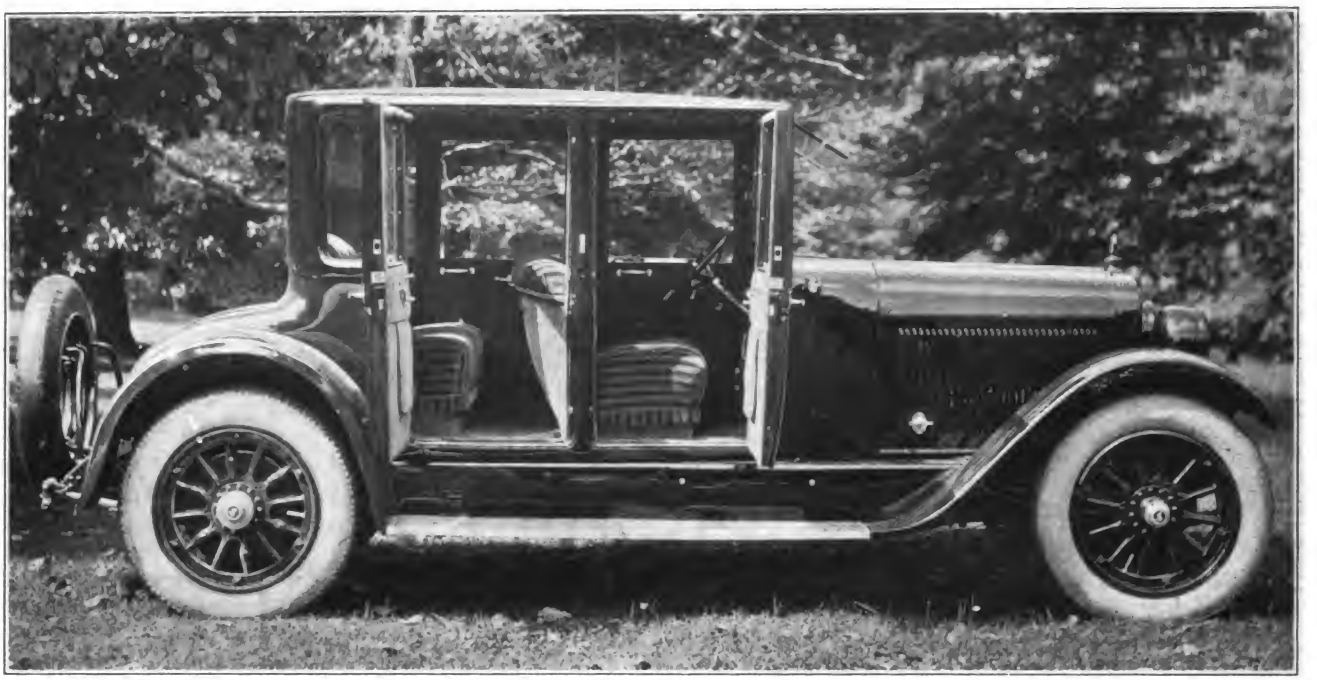
The next oil to consider is an oil which perhaps is not quite so familiar as linseed oil, being China wood oil, an oil made from the nuts of the tung tree, a tree indigenous to China, growing largely in the interior of China, particularly along the banks of the Yangste river. These trees bear fruit about the size of a small orange. Each fruit contains five segments, each segment containing a kernel. The fruit is roasted over a fire, which breaks open the segments, the kernels separate and these kernels are then placed in the crushing machines.

The form used by the Chinese for this purpose consists of nothing more nor less than a large stone which is rolled back and forth in a trough and the kernels crushed. A more modern crusher consists of a large stone weighing several tons. This is drawn around within a circular trough by means of mules, horses or other animals, and the kernels as they are crushed, gradually move towards the center. It is very primitive means of carrying out these processes, but it must be remembered that individual Chinamen carry out the process on their own farms and therefore the machinery cannot be very complex The powdered China wood oil nuts are then tempered, that is, they are placed between bamboo mats and heated over a kettle of boiling water until the powdered nuts have picked up sufficient moisture and the mats are then placed edgewise in the large press. This press is also of primitive

(Continued on page 27)

Some Recent American Enclosed and

The great progress which the enclosed body is making in this country is well shown in the illustrations herewith, showing some of the newest fine coach work



NEW LAFAYETTE FOUR-DOOR FOUR-PASSENGER COUPE WITH BOTH DOORS OPEN

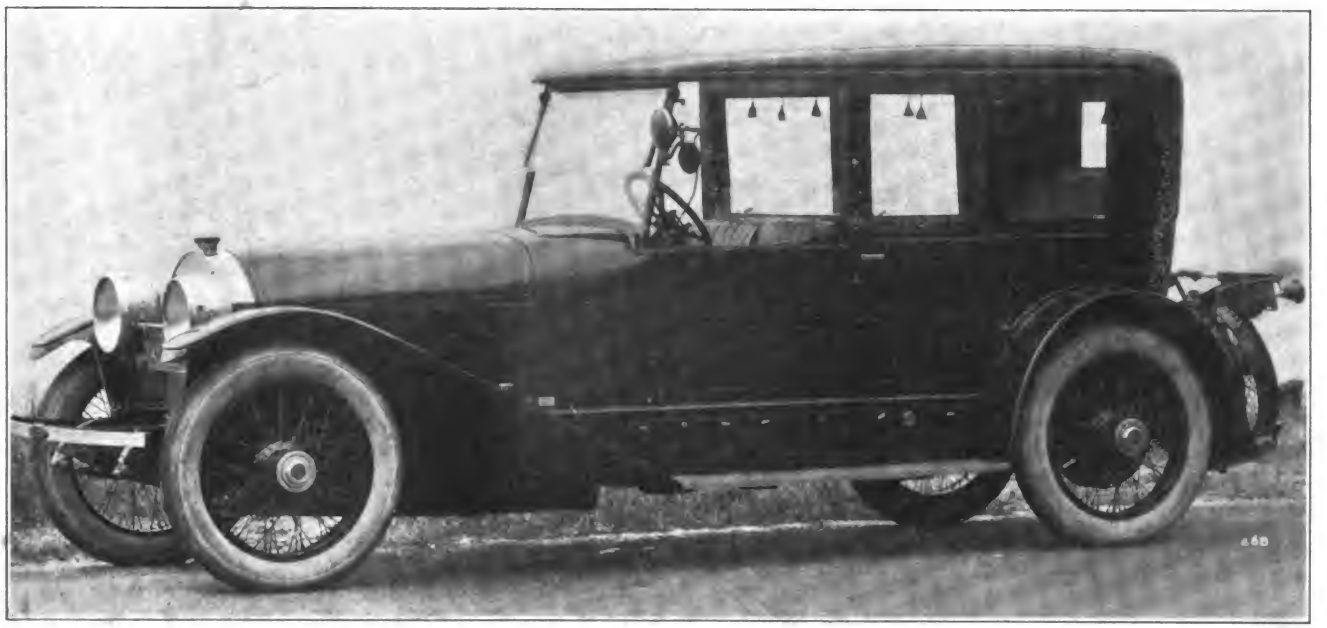
Four doors give immediate access to or exit from all seats. Lafayette eight cylinder chassis, built by Lafayette Motor Co., Indianapolis, Ind.

LEXINGTON T SEVEN-PASSENGER SALON-SEDAN

Note straight square lines, especially doors. Lexington chassis, built by Lexington Motor Co., Connersville, Ind.

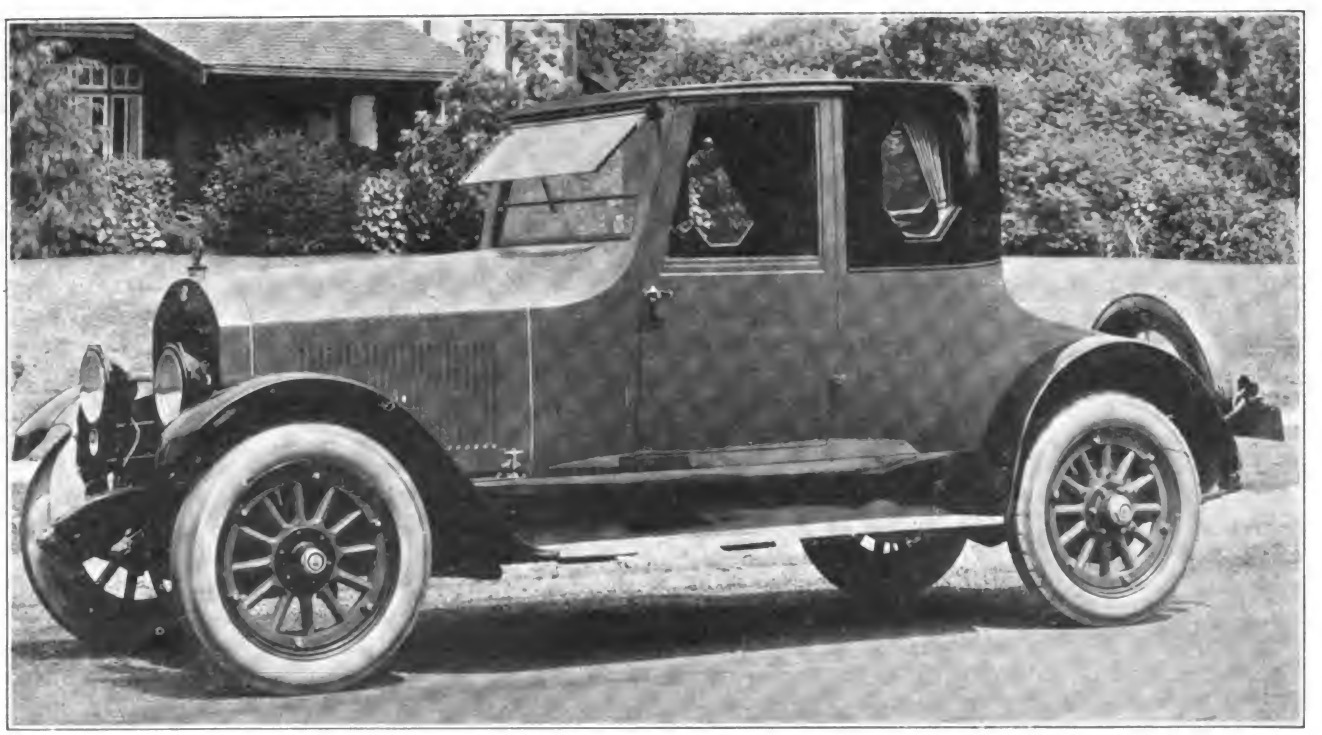
All-Season Examples of Fine Coach Work

These beautiful bodies show not alone the coming all-year body f -m the sedan, but several smaller and more cosy forms, with both two and four doors



COLE AERO-EIGHT FOUR PASSENGER SPORT COUPE

Note square lines and hexagon-shaped windows on this two door job. Cole Model £83 chassis, built by Cole Motor Car Co., Indianapolis, Ind.



LOCOMOBILE CUSTOM-BUILT ROUND CORNERED COUPE- LIMOUSINE

This body with permanent extension over driver has silver gray whipcord and enamel interior. Locomobile chassis, built by Locomobile Co. of America, Bridgeport, Conn. (Hare's Motors)

The Motor Truck Situation and Prospects

Statistics Showing Present Position of Motor Trucks in Our Industrial Structure, Including Registrations, Production, Exports—Present-Day Problems, Carburetion, Bodies, Weights, Tires

EVEN the most advanced pessimists in the automotive industry grant the motor truck in all its present forms a satisfactory situation now and a remarkable future. Unfortunately the present business depression has hit the truck industry almost as hard as it has the car makers for they have had to contend not alone with the unwillingness of business men to spend money but also with parts and materials factories closed or on part time, which meant slow deliveries. The truck is a business utility and consequently must be sold on the basis of delivery of value, as well as against strong competition much of it purely on a price basis. These things have combined to make the truck sales of recent months far from the satisfactory tota's which even the pessimists granted it in theory.

At the beginning of a new era of good business, it will be well to give the whole truck situation a careful inspection, from the inside as it were, and with the questions in mind, what are the present problems, how are they being met, what does the future hold, and what influence will present changes have upon this.

Before starting this perhaps it will be well to state and define the present status of the motor truck. There are now more than one million motor trucks in use in this country, New York state alone having in excess of 150,000, and a group of nine of the so-called manufacturing states having more than 539,000. These figures and others will be found in Table 1, which gives the 1919 and 1920 registration figures by states. The fact that truck production held up in 1920, despite the conditions of the last half of the year, and exceeded 1919 by a considerable margin shows that the demand taking the year as a whole, was very good. As Table II shows, the production total is estimated at 335,000, which was greater than 1919 by 20,000. This is an increase of but 6 4 per cent, but if the values be examined they will throw more light on the matter. The value of the 1920 output, wholesale, was $700,000,000, compared with $423,326,621 for 1919, an increase of roughly $277,000,000 or 64.2 per cent. From this it is seen that while the actual number in use did not increase as greatly as had been expected, the wholesale value increased just ten times as much (64.2 per cent against 6.4 per cent). In fact the average value per truck has gone up within a few dollars of the highest since truck manufacture became a real industry. The column of average values is interesting because it reflects the continuous reduction in prices which took place from 1911 to 1915, when the war influence began to be felt. Since then the average has fluctuated, but it can be stated that the trend is again downward, and lacking another world-upheaval, will continue downward.

Not alone has the industry become stabilized at home, as registration and production figures show, but the world market for them has been increased to a marked extent, as Table III shows. This gives the truck exports in recent years, as well as the total car and truck exports. The final column indicates the truck proportion of the total. In this connection it should be noted and recognized that the war had a tremendous upward influence on American trucks, practically every allied power buying American trucks in huge quantities. This accounts for the 1915 proportion of practically 65 per cent of the total, for the 1916 proportion of 58 per cent, and in largest part for the 1917 and 1918 high proportions.

It will be noted that 1920 with the comfortable total number of nearly 30,000, valued at more than $47,000,000, an increase of 87 per cent in number and 33 in value, has now settled down into the more normal proportion of a little more than one-fifth the total vehicle exports.

In the way of gross business, it will be noted that the last 8 years have produced a total approximating three-quarters of a billion. If the figures for 1921 show no greater increase than did 1920 over 1919, a business of $70,000,000 in motor trucks, and of $315,000,000 in cars and trucks combined may be looked for.

These tables show in a general way that truck production is now upon a plane of about 400,000 vehicles a year, valued at roughly three-quarters of a billion, of which foreign countries absorb about 40,000 valued at about $60,000,000, while home markets take the rest. Comparison of registration and production figures show that more than 100,000 old vehicles are put on the shelf each year now, so that replacements may be assumed to have passed this figure.

The truck has been a tremendous influence for good upon the roads of the country. Without belittling the passenger car influence, which has been perhaps more widespread, it may be stated that the truck has been the largest and most insistent factor toward permanent hard-surfaced roads, connecting our larger cities. And this influence is continuing and growing greater each year. With reference to the whole truck situation, including all present and future design questions, good roads influence, etc., what follows represents a summary in brief form of the opinions of a large number of prominent men in the industry.

The heavy duty motor truck is in the nature of a public utility and whether its use is justified or not is entirely dependent upon whether, as a transportation agency, it ultimately saves to the consumer dollars and cents in the cost of produce handled by it over the highways. This saving when analyzed will be found to be very material; if you will visualize for a moment the number of times that a spool of thread is handled over the highways, from the time the cotton from which it is constructed is grown, to the time when it is delivered to the ultimate consumer, you will find that it has been handled considerably more than ten times, with the result that the saving of a very small fraction in the cost of hauling each time will very materially affect the competitive sales price of that article. In other words, the use of the motor truck, both in the handling of passengers and freight, is entirely an economic proposition for the benefit, according to the leading motor truck author-

ities, of the country at large. If that is so, there is no justification for limiting by legislation the use of the highway by that vehicle.

The motor truck fraternity in large part is therefore of the opinion that the trend of legislation should not be toward the enactment of new laws further restricting the use of the highways, but an intelligent survey of the purpose of highways and the enforcement of present laws as to their use. It is too of the opinion that the highway is of such material benefit to the general public that the cost of the construction of the highway should be borne by the public through general taxation. Again the authorities believe the user of the highway should pay for the maintenance of it, and therefore a tax on all users of the highway based as nearly theoretically as possible on their use of it should be enacted in order to maintain that highway in a condition which will carry the traffic which goes over it. These men do not believe that the motor vehicle is a subject for Federal taxation. It is not essentially a long distance or interstate carrier and it is already heavily taxed through personal property taxes, license fees and special excise taxes.

Motor truck opinion in general, is that the development of road legislation has conclusively demonstrated that the Federal government should assist in the construction of important highways throughout the United States. It is particularly in favor of the Townsend bill, which provides for a system of Federal highways constructed and maintained by the Federal government. The experience of the industry has been that in order to effect any efficient solution of the highway problem it is necessary that the authority in reference to the highways in the various states be centralized in either a highway commissioner or a similar office in order that the state may control the development of its intercounty and main market highways along the lines of the development of Federal highways, whether constructed entirely through Federal funds or under the present method of Federal aid. The importance of the question of highway transportation has been disregarded in a remarkable manner when it is considered that all movements of produce in the course of their production from raw material to the finished products, start over the highway and finish over the highway. As a method of transportation and as a solution of the short haul problem, it far outranks in importance either waterways or railways.

Engines to Fit the Fuels

Leaving the road question behind us, we come to the timely matter of engines and engine design, particularly as they pertain to the lower grades of gasoline now being handled. In general, motor truck builders are not doing as much with regard to meeting the lower grade fuels as the passenger car builders. This in large measure is due to the fact that many motor truck builders do not make their engines and other parts. The engines and carburetors are purchased from companies specializing in those products, and the motor truck builders are content to leave fuel problems in the hands of those concerned.

However there is some development going on, never-

Table I—Motor Truck Registration Figures

State	1919†	1920	State	1919†	1920
Alabama	10,249	12,696	Nevada		500*
Arizona		4,733	New Hampshire	3,743	4,440
Arkansas		3,500*	New Jersey	19,499	23,612
California		34,078	New Mexico		6,000*
Colorado		7,728	New York	119,918	147,873
Connecticut	18,861	24,011	North Carolina	9,192	13,455
Delaware		1,800*	North Dakota	1,314	1,455
District of Columbia	5,600	6,826*	Ohio		81,518
Florida	6,806	10,448	Oklahoma		9,000*
Georgia	10,000	14,000*	Oregon		10,000*
Idaho		2,000*	Pennsylvania	40,893	48,329
Illinois		64,997	Rhode Island	8,339	9,575
Indiana		32,481	South Carolina	9,000	9,200
Iowa		30,000*	South Dakota		9,500
Kansas		26,000	Tennessee		11,638
Kentucky	9,195	13,259	Texas		30,000*
Louisiana	510	6,600	Utah	5,000	5,692
Maine	5,795	1,512	Vermont	2,402	2,916
Maryland	10,806	11,432	Virginia		13,670
Massachusetts	41,810	51,386	Washington	12,275	25,864
Michigan	37,105	45,771	West Virginia	6,436**	10,802
Minnesota		19,400*	Wisconsin	10,880	16,205
Mississippi		4,765	Wyoming		1,000*
Missouri		23,700*			
Montana		1,200	Totals	420,538**	971,567
Nebraska	15,000	19,000		750,000†	

*Estimated by A. A. A. from best available data.

**Special privilege commercial cars—otherwise not registered separately.

†1919 figures taken from Nat. Auto. Chamber of Commerce data book. Elsewhere in the book, truck registration totals are estimated at 750,000, which allow for all states not registering trucks separately, and must be considered as actual 1919 total.

Table II—Motor Truck Production Totals by Years

Year	Number	Wholesale Value	Average Value
1904*	411	$946,947	$2,304.00
1909*	3,255	5,230,023	1,606.00
1903-1910 incl	10,374	20,485,500	1,974,69
1911	10,655	22,292,321	2,092.19
1912	22,000	43,000,000	1,954.54
1913	23,500	44,000,000	1,872 34
1914*	25,375	45,098,464	1,777.28
1915	74,000	125,800,000	1,700.00
1916	90,000	157,500,000	1,750.00
1917†	128,158	220,982,668	1,724.31
1918†	227,250	434,168,992	1,910.53
1919	316,364	423,326,621	1,338.07
1920	335,000	700,000,000	2,080.95

*From U. S. Census reports.

†Production figures compiled by Automotive Products Section, War Industries Board, from sworn statements by manufacturers.

Table III—Motor Truck Exports

Year	Number	Value	Per cent increase in value	Total motor vehicle exports	Truck per cent of total exports
1913*	993	$1,737,141		$26,012,934	6.6
1914*	784	1,181,611	31.4a	26,574,574	4.4
1915*	13,996	39,140,682	3211.6	60,254,635	64.9
1916*	21,268	56,805,548	45.1	97,465,811	58.3
1917*	15,977	42,343,502	25.4a	90,956,134	46.5
1918*	12,200	31,874,459	24.7a	77,205,825	41.2
Last 6 mos. 1918	5,401	14,637,236		30,335,342	
1918†	10,308	26,814,952		63,093,244	42.5
1919†	15,585	35,425,437	32.0	109,125,964	32.5
1920†	29,270	47,105,541	32.9	212,085,553	22.2
Total 1913-1920	115,474b	270,251,157b		730.016,772	37.0

*Fiscal year.

†Calendar year.

a decrease.

b 115,241 valued at $271,904,772 according to Automotive Industries.

Best truck customer in 1919, France 3,521 trucks worth $15,143,226.

Best truck customer in 1920, England 4,995 trucks worth $7,148,880.

Best truck customer 1913-20, France 23,378 trucks worth $78,695,244, or England 32,006 trucks worth $74,522,829.

theless. Several motor truck builders are endeavoring to heat the gas being admitted to the cylinders by means of exhaust gas, the exhaust gas being controlled by a throttle. Others are installing a hot manifold on the engine so as to make the gasoline vapor more thoroughly combustible. One manufacturer is engaged in developing a satisfactory fuel for motor cars. A hot spot manifold has been developed and is being used on at least one make of motor truck, which successfully handles one-half gasoline and one-half kerosene.

Whether or not we shall have to go to still lower grades of fuel is a controversial matter, with the decision seemingly with those who say we shall not, since we have perhaps already reached the lowest practical point. As long as there remains so little difference between the cost of gasoline and kerosene, or other similar low grade fuels, the public will not demand or put up with the inconvenience accompanying their use. But it is well to bear in mind that the situation in foreign markets is different. In some countries the cost of gasoline is prohibitive, and motor cars and trucks are forced to operate on the low grade fuels, such as kerosene, benzol, alcohol, and so on. To meet these requirements and also to secure better vaporization of the present day gasoline, certain manufacturers use motors the inlet manifolds of which are properly jacketed by the hot exhaust gases, as already mentioned. At least one make of motor truck for this year is being equipped with a special carburetor of the so-called fuel converted type. This device itself burns part of the fuel in order to obtain the heat necessary to obtain proper vaporization of the fuel before it is introduced into the engine cylinders. This carburetor will burn any kind of mineral fuel having a gravity above 36 deg. Baume. Some one, two and 3½ ton trucks equipped with this new carburetor were recently shipped to the Province of Viscaya, Spain, equipped for alcohol fuel. Though not as satisfactory as gasoline, they are reported to be doing very well in Spain, where it is possible to obtain high grade test alcohol at a price considerably below that of gasoline. Therefore under certain conditions alcohol can now be used.

As in the passenger car field the gasoline type remains supreme and unassailable despite the many efforts along steam and electric lines. The steam and electric types have failed to meet the exacting conditions of highway transportation. The many handicaps of either of these types have not been overcome to a sufficient degree to warrant their replacing the tried and proved gasoline type. The electric truck has gained some adherents true, but only for very short hauls and in city work. As a real competitor of the gasoline truck, it is negligible, at least so long as the present designs are followed out. It may be that at some distant date we shall see a vast improvement in electric vehicles, and certain fundamental disadvantages, such as the storage battery of limited capacity, will be overcome; but it is almost certain that in our day the gasoline truck will remain as the leading means of highway transportation.

Some Remarks About Bodies

The question of bodies is not the same with motor trucks as it is with passenger cars. In the latter case the bodies may be more or less standardized—and they are in the latest offerings; but with motor trucks a special body is required for almost every special kind of service. Thre is little opportunity for body standardization, since to standardize a body would mean to take away from the value of any given motor truck for the peculiar requirements of the user.

Thus there is less to say about bodies than we had hoped for. Still our question has not been entirely barren of results. One manufacturer informs us that he furnishes 95 per cent of all his trucks with bodies built for the specific work to be done by said trucks, which seems a very commendable practice. The truck is made to fit the job, so to speak, instead of warping the job to fit the truck. Others are also following out this practice in that they are endeavoring to take up individual body requirements of the users. While it is true that a standardized coal or live stock body may meet the general requirements of such services, there are bound to be times when a spe-

cial body would mean a very material saving in the course of a year's service, repaying many times the small additional cost of a body especially built to fit the job.

Yet it is also true that there is opportunity for standardization, namely, in the chassis. One manufacturer suggests that truck builders should come to a standard dimension from dash board to back of seat box and for the width of two or three-men cabs, so that the body builders could make up cabs in quantities and bring down their costs, thus effecting a saving to motor truck builders which could be passed on to the buyer. This would certainly be a step forward in production.

Are motor truck bodies too high? Perhaps there is room for thought in that question, for a leading engineer states that in his belief motor truck bodies will have to be made narrower or wheel housings will have to be included in the bodies in order to allow the platform of the usual body to be nearer the ground.

Saving a Few Pounds Here and There

Pound by pound the motor truck builders are shaving down their truck weights in order to secure more economical operation, consistent with long wearing qualities and efficient service. As an instance, one builder has just put into production a tubular type propeller shaft which reduces the total weight of his truck just 32 pounds. In his quest for lighter weight this same manufacturer some time ago, eliminated torque and radius rods as he found that the rear springs could be made to do their work better and at the same time eliminate between 400 and 700 pounds of weight.

Another builder has reduced the unsprung weight of his car 200 pounds by using pressed steel axle housings instead of malleable iron or cast steel. On the one hand designers are simplifying and eliminating parts here and there to reduce weight, while on the other the engineers are turning to lighter alloys and metals.

Aluminum, we find, is being used in moderation. It is employed by some for crankcases and underpans in order to reduce motor weight. Aluminum alloys seem to hold out the most promise for continued weight savings along these lines, but progress with these has been slow, partly due to a lack of faith in the strength and reliability of aluminum which holds over from the early days, and which many designers and constructors still retain. An alloy which is as strong as some grades of cast steel for rear axle housings and similar parts, is claimed to save several hundred pounds on the larger vehicles. With suitable price reductions in this metal, so that the industry could take advantage of the war-doubled production facilities for aluminum, it could be used to a much greater extent through the truck, with weight savings running to hundreds of pounds, and in the larger sizes to thousands of pounds.

Regarding structural parts, drop forgings and pressed steel parts are gradually replacing heavier castings. Heavy alloy steel is used in parts having to resist greater strains but more from a standpoint of increased strength than a reduction of weight. Of course there is a limit to how light a motor truck can be made, consistent with efficiency. A motor truck must have enough weight to get traction, that's certain.

The subject of weight introduces that of tires, which in the case of motor trucks looms up quite big in view of the keen rivalry between the solid and the pneumatic types. The consensus of opinion is that the use of the pneumatic tire on trucks has opened large new fields which could not be approached with the solid tired vehicle. The pneumatic tire permits higher speed with heavy loads on good roads and is also particularly adapted to soft roads since it does not cut into them as deeply as the solid type.

Pneumatic or Solid Tires?

Automotive authorities do not look forward to any radical changes in the tire situation, except that cushion tires are likely to become more common. As for the choice between pneumatic and solid tires, this is largely a question of circumstances. Some authorities recommend solid tires for use on the larger motor trucks employed for city service, and pneumatic tires on the smaller trucks and up to 2½ ton capacity. For country use especially over roads that leave much to be desired in the way of smoothness, pneumatic tires are recommended.

Obviously this all means when boiled down to essentials, that the pneumatic tire has proved its worth in the past few years since its introduction. Motor truck builders appear to be quite enthusiastic over the pneumatic tire, which offers greater resiliency and therefore permits of greater speed on the one hand and better protection to the vital parts of the truck. Furthermore better traction can be obtained. All these factors mean much in the way of lowered transportation costs. Again, pneumatic tires prolong the life of any truck and save on repairs. However as one authority points out, their maintenance cost has caused some users to discard them. It seems as though the solid tire and the pneumatic tire each have their proper field, and sooner or later they will settle down in those fields with little or no conflicting opinions regarding their most efficient applications.

What of the Future?

The motor truck is no longer an experiment. Its field is pretty well defined. It has solved the problem of short hauls and is the best known means or radii for connecting railroad diameters, as one authority puts it. Up to 150 miles, the motor truck is he'd to be the most economical form of rapid transportation. Its place in our transportation scheme is between the horse and the railroad: but it will be some time before it displaces entirely the former.

As for novel applications, aside from the motor truck's regular use as a short haul transport there appears to be no limit. Today we find motor trucks equipped with flanged wheels doing duty on branch line railways and small railways, where the traffic does not warrant expensive steam or electric trains. With suitable bodies, trucks are carrying tourists to the battlefronts of France. Many adventurous folks are touring the world in special cars (or houses) mounted on truck chassis. Hotels and summer resorts are using de luxe bodies on truck chassis for carrying their guests to and from the railroad stations or boat landings. City and country buses are now mounted on truck chassis, former heavy touring car chassis having been found unsuitable. In fact in thousands of other lines of endeavor the truck is making headway, which means more business for the truck manufacturer in the near future. Farmers are very large buyers of both standard and special trucks, their holdings being estimated at 80,000. Cities and municipalities are buying many standard and special trucks, as are state, county and government departments. The postal delivery service is half motorized and so the march of the truck into all business lines continues.

Building the Small Car and Its Body

The Various Processes Through Which the Parts Used in the Small Car Must Pass, Including Body and Painting Work, With Especial Reference to the Chevrolet Practice

MANY persons with little or no knowledge of motor car manufacture, erroneously assume that the small car, because it is small and low in price, is necessarily cheaply constructed. By cheaply is meant poorly, slurring many points of importance. The fact is entirely overlooked that the person buying this class of car is just as proud of its appearance as the buyer of more expensive vehicles. He expects just as much for his money in the way of comfort and ease of riding, convenience of operation and lack of care needed, and above all, he expects to get as great a life or a greater one, in proportion to what he pays, than does the more wealthy buyer. From which it is self-evident that the small car can not and in fact is not constructed or assembled in a poor, shoddy or shiftless manner. Naturally in order to produce the vehicle at the lowest possible selling price, there must be economies of design, economies in materials used, and above all, marked economies in method of assembly, but these are economical methods rather than poor or shiftless methods, and include in fact the doing of all things that should be done, and in a workmanlike manner.




Steps in the manufacture, trimming and finishing of Chevrolet bodies. Fig. 1. Frame in its cradle. Fig. 2. Adjusting sheet metal Panel Sections. Fig. 3. Burnishing before enameling. Fig. 4. Upholstering the body

All of which leads to a description of the methods of constructing one small car, the Chevrolet, and especially of its body and top. These more or less external parts will be taken up first, and then as space permits, the mechanical parts.

First it should be stated by way of explanation that the material, parts and assembing work is progressive, that is the cars are built on the so-called progressive assembly plan. In this, the sub-groups are each assembled separately and brought toward the progressive car and body assembly at the point where these parts would be needed. That is the engines come to it at a point near the beginning, the bodies at a point very near the end and so on.

Beginning in the large building devoted to body building, a visitor would note neatly arranged stocks of small wooden parts, each cut and machined accurately to size, waiting to be formed into the completed bodies. Men at a long, continuous row of benches were busily engaged in assembling these small pieces with other pieces of wood or metal, and wherever two pieces of wood were put together they were not only glued, but held solidly in place with screws.

The method of building the bodies too is similar to the method used in chassis construction. That is to say, the body actually progresses through the plant and is built, finished and equipped as it goes.

Each operation that it undergoes adds form and feature to it. Its progress is so systematized that one step follows another in just the proper sequence to give the most efficient results.

And each operation is performed by specialists who do only one kind of work and do that one to perfection.

Each carpenter has his pile of parts on either side of what is known as a "cradle," that is really a rigid guide to accurate construction. Into this cradle each part is fitted according to definite meaurements, much as the hull of a ship is built, and each is joined securely to the other as it takes its place.

As the frames of all Chevrolet bodies are built in cradles of the same dimensions, preciseness is assured in every one of the Chevrolet plants in the country.

When the frame has been completed, it is rigidly inspected and then dipped in a vat containing a preservative solution. After it has been thoroughly seasoned to withstand the effects of time it is ready for its armor of sheet metal.

When the sills had been assembled the floor board irons were attached and the tonneau floor plan, crown and toe blocks were put on. The frames were then placed in iron jigs for final assembly. Locked securely in the jigs one




Further Steps in Making the Tops and Completing Chevrolet Cars. Fig. 5. Piecing top and curtain material. Fig. 6. Constructing tops. Fig. 7. Chassis completed ready for body. Fig. 8. Bod y ready for chassis

could see why one "Four-Ninety" body is exactly the same size as another, because every part of the frames was made to register exactly with the indicated places in the jigs. While firmly gripped in the jigs, all parts of the frames were gone over and fitted before being glued and

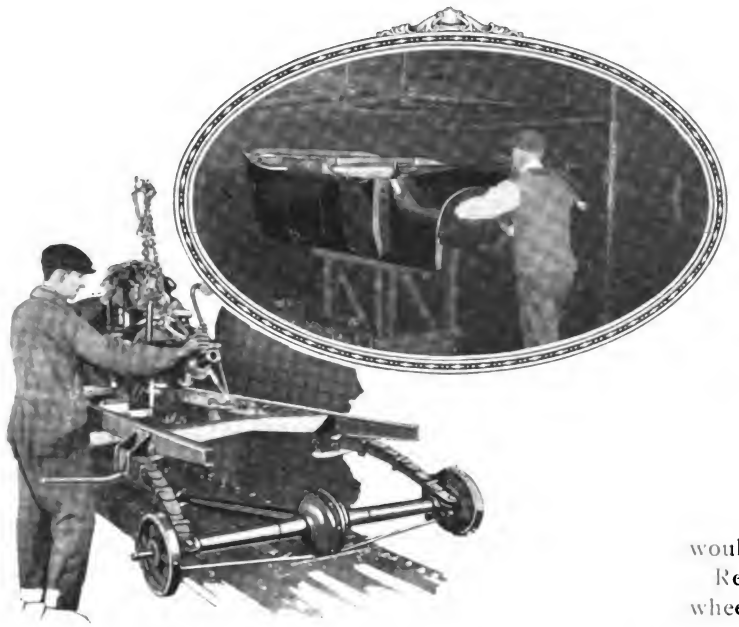


Fig. 9. Lowering the motor into place after springs and axles have been attached. Above—Placing the freshly enameled bodies in the bake oven

screwed together. Electric glue heaters were attached right to the jigs, and electric drills, with other tools, were always ready for convenient and instant use. Two heavy brace irons were attached to each frame to support and stay it while going through the different finishing operations. Drawknife, saw and file were then used to refine the frames for the painting process.

Removed on trucks to large spraying cabinets, the frames were given a priming coat.

Four main operations only are needed to cover frames and the metal used has been previously shaped to cover exactly the space for which it is intended. The cowl and dash are first fitted as one piece. Then the whole back is laid on.

Next come the panels between the doors and last of all the doors themselves.

When all the metal sections have been securely fastened to the frame the whole is passed on to the buffers. Flywheels of fine emery are passed over every inch of surface in order that every possible imperfection may be entirely eliminated. And as a further precaution it is next thoroughly washed down with pumice. Burnished and scrubbed the body now travels over to the enameling department where the coats of enamel, any one of which

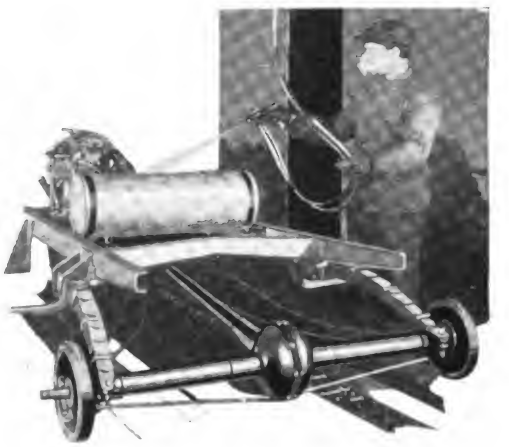


Fig. 10. Enameling the finished chassis at the entrance of the drying oven. The spray method saves both time and paint

would outlast the lift of an ordinary machine, are applied.

Ready now for the first coat of enamel, the bodies were wheeled to large flow pans, so placed that all enamel dripping from the bodies was strained and carried back to the supply tank to be used again. A flow coat of enamel was first applied to the front seats, then a similar application was given the exterior of each body. The wet bodies were then wheeled into the large baking ovens. Extending the full length of the long room were 24 enormous baking ovens—each large enough to easily accommodate eight of the "Four-Ninety" bodies. The ovens were heated with gas and each was provided with a thermometer and chart to register exactly the temperature prevailing at any minute of the day. After each of three different applications of enamel to the bodies, they were placed in the ovens and subjected to a temperature of 250 degrees for from 1½ to 2½ hours.

When the last coat is dried and minutely inspected the body passes into the hands of the trimmers. Here are really many departments in one. Some of the work is done exclusively by men and some by women.

There are cutters using electric knives and seat-stresses operating numberless sewing machines.

And there are upholsterers fitting in springs, hair and leather facings that make up the backs and seat cushions;

(Continued on page 25)

Fig. 11. Chemical laboratory where all analyses of metals are made

Fig. 12. Straightening and balancing camshafts, a job for an expert only

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Changing Labor Conditions

EVERY period of deflation is accompanied by changing labor conditions, and the present is not different. Automotive manufacturers planning for a big year's business in 1921 and a much bigger and better one in 1922 would do well to make such changes as they feel are necessary with a view largely to the future. This is no time for abrupt changes, which better business of two, four or six months from now may change back as abruptly.

In considering any changes of method, hours, payment, bonuses or otherwise, the automotive employer might give thought to this example of two munitions companies during the war period.

In the shops of one of the concerns a bonus system prevailed and under it the greater strength, endurance and facility of movement possessed by the younger men was reflected in their ability to produce more shells and thereby add more to their wage than could the older machinists. Some of the latter, seeing their juniors—usually men of less skill as well as experience—outdo them in the matter of money received became dissatisfied and sought employment in another plant. When they made application they were heartily received and they entered an establishment where the pay was good but where no bonuses existed.

The plant with the bonus system had a high rate of rejections, the loss of which fell on the company. The men received their bonuses for the faulty as well as for the good shells. In contrast, in the plant where there was no bonus system there was not the same rush to turn out work and the rejections were very few, so few in fact as to be a matter of wonder. Frantic production was lacking, and perhaps there was less of the driving spirit, but the energy used was properly and efficiently applied, all making for thoroughness and naturally a larger percentage of product acceptable to the inspector. In time past, it is no secret and the same is true today in some places—that machine tools have been battered to pieces by mistaken haste, crudely applied force and lack of judgment.

It will not do to generalize too broadly from the two cases cited, but the facts are presented for whatever instruction they may convey to those charged with the responsibilities of shop management.

In this connection it will be well to consider the views of H. M. Leland, one of the Grand Old Men of the automotive industry. He believes that careful training of operators produces results superior to elaborate systems of inspections and checking. Generally speaking, workmen are left very much to their own resources, which may be meager enough. Great reliance is placed upon the inspection department, where the inaccuracies due to incapable, untrained workmanship are discovered, when they might have been largely prevented. With careful training of machine operators, the work of the inspection department could be materially reduced, in the opinion of Mr. Leland. There would be less spoiled work and fewer parts requiring remachining—all resulting in large savings in costs of production.

Inspection service will always be necessary in our highly organized industries, but the statement that inspection departments in modern factories are much larger than necessary, while preliminary training of the workers is neglected, comes with great force from a man of Mr. Leland's lifelong practical experience in mechanical work. A little more attention paid to training would save a great many dollars now wasted, and besides reducing the cost of the finished product, would improve its quality. Incidentally it would reduce labor turnover, for the trained, responsible operator is worth more than the other kind, can earn more, and has greater respect for his job.

New Materials—New and Better Results

TODAY the whole world wants new and better raw materials, but different ones want these for different reasons. Those who have found business stagnant want new materials so as to have new selling arguments, which will stimulate business. Aside from starting the wheels going, to these the new selling argument which the use of new materials would bring, would continue as a superiority over competitors. Others want new materials because of the new results they may bring, superior to the results produced by old or present materials.

Still others, consumers, want new materials because they want things which are better, or cheaper, or longer lived, or lighter in weight or color, or different or better in respect to some other qualities. In this issue some notes are presented relative to new materials along paint and varnish lines, and some facts on a little known wood, which should be a desirable material for coach and body builders. This material has been presented with the hope of assisting not alone in the present peculiar business situation, but in the thought of permanent benefit as well to the industries concerned.

The Minister of Posts and Telegraphs has announced an airplane mail service between Budapest and Belgrade, to begin November 29, 1920, and to carry at first only letters and postal cards.

General Utilization of Sycamore Wood

W. D. BRUSH*

Some Little Known Facts About This Desirable Wood, Which Has Many Admirable Qualities Making it Suitable for Body Building and Other Lines

ALERT body builders as well as other large users of wood in any form, are, and logically should be, constantly on the lookout for new raw materials. The following facts are presented relative to the wood sycamore because it is one of the most important commercial woods of the United States, is available in considerable quantities, at a reasonable price, has many sterling qualities which would fit it for this work, and yet it is ranked about twenty-sixth in the list of native woods, according to consumption, this list including thirteen hardwoods which are used in greater quantities. This is not as it should be, for as stated it is a desirable material with many very good qualities. In general it is a uniform colored, clean-looking wood, which presents a very good appearance when manufactured, that is in the finished product. The heartwood is brown tinged with red; the sapwood is lighter in color. Plain sawed sycamore has little figure, excepting the lighter colored bands which mark off the annual growth layers from each other. Due to large medullary rays, it usually has a slightly mottled appearance. In quarter sawed wood, these rays are very conspicuous and resemble the figure in quarter sawed oak. In oak as in most other woods, the rays are lighter than the rest of the wood, while in sycamore, the rays are darker, consequently quarter sawing produces quite a different effect on the appearance of the wood. It takes different finishes in a very attractive manner.

It ranks as a moderate wood, being classed as moderate in hardness, weight, stiffness, strength, shock resisting ability, shrinkage, warpage and splitting qualities. It has a strength of about 6,500 lbs. or about 75 per cent of oak, in bending, and 2,930 lbs. or 83 per cent of oak, in compression parallel to the grain, and 450 lbs. or 62 per cent of oak, in compression across the grain. In most of its other physical or measurable qualities, it bears about this same relation to oak, that is from 60 up to 90 per cent. Its shrinkage approximates that of oak, tangentially being 84.4 per cent, in volume 99.3 per cent, but radially it is 104.1 per cent of oak. Although in these various qualities it ranks roughly at 75 per cent of oak, compared on the basis of dry weight or specific gravity when dry, it excels oak in compression parallel to the grain, and in stiffness; is about equal to it in shearing strength parallel to the grain and strength in bending; but is slightly below it in compression perpendicular to grain, hardness and shock resisting ability.

The largest drawback is its durability. In exposed situations the average life of the untreated lumber in the United States is from 3 to 5 years, with the life of individual sticks higher according to the quality of the wood and conditions. Figures are not available as to its life when treated, but the nature of the pores of the wood, as will be shown, are such as to lend themselves well to creosoting and various other treating processes, a number of which do not discolor the wood.

*Scientific Assistant, Forest Service, U. S. Dept. of Agriculture. Abstracted from Agricultural Bulletin No. 884.

From a truck or other automotive body standpoint, this length of life does not differ widely from the generally accepted chassis of mechanism life. That is the average car has been considered to have a life of 5 years, now it is admitted that cars are made better and from better materials, so that the average car is considered to have a life of 6 years. Based on these figures, it would seem that the life of this wood in the form of a body would be at least as great as that of the chassis on which it would be placed.

Sycamore does not impart odor or taste to substances in contact with it, nor does it stain them. This quality, together with its moderate strength and the difficulty of splitting the wood, have made it particularly suitable for containers, in which perhaps one-half of the total is used, and should make it equally suitable for container bodies, such as ice cream, bakery, butcher, other meat, milk, and other provision bodies, as well as all refrigerated bodies.

Weight and Structure

The official standard weight of the Nat. Hardwood Lumber Assn. for rough sycamore lumber 1 in. thick is 3,000 lbs. per 1,000 board ft., and for green lumber 4,750 lbs. The government figures agree with this approximately, being 3,000 lbs. and 4,300 lbs. respectively. In structure, sycamore is a "diffuse porous" wood; that is the pores or vessels of the wood are nearly all of the same size and quite evenly distributed throughout each annual layer or ring of growth, and the annual rings are marked off from each other by light colored lines. The medullary rays are numerous and conspicuous and practically all broad. In this respect the wood may be compared favorably with beech and birch, both diffuse porous hardwoods. Beech has broad rays but it also has many narrow rays and the broad ones are unevenly spaced, whereas in sycamore the rays are all broad and all evenly spaced. In birch the rays are all narrow.

Range and Size of Sycamore Trees

Practically all of our native sycamore wood comes from a single species, platanus occidentalis, which grows throughout nearly all of the eastern half of the United States. Other names applied to the tree are buttonwood and buttonball. Two other species occur in the western part of the United States, but these are unimportant commercially, yielding only a small amount of timber for local purposes. The common eastern sycamore usually grows to a height of from 75 to 110 ft., and a diameter of from 2 to 5 ft. There are records of sycamores measuring up to 14 ft. in diameter and 140 ft. in height, and a few such trees are still found. It is therefore the largest hardwood of the United States in size of trunk, but not in height.

Sycamore trees do not as a rule yield a large amount of the highest quality timber because of the shortness of the clear length of stems. Large logs are frequently shaky and often hollow, and on this account there is a high percentage of waste in the manufacture of lumber

and veneer. Logs over 20 in. in diameter are likely to be very defective. Smaller second growth logs are usually quite sound. The southern sycamore is said to be often badly affected with worm holes, which makes it unsuitable for most uses.

Commercial Supply

The principal supply of sycamore is from that part of the central hardwood region which includes West Virginia and Missouri, the states lying between them, and Arkansas and Tennessee. The greatest supply of sycamore is located along river bottoms in the Ohio and Mississippi Valleys and along the large streams tributary to these rivers.

The principal center of the sycamore industry seems to be at present located near the junction of the Ohio and Mississippi Rivers. Much sycamore is available in this region along these streams and their large tributaries and therefore many factories using large amounts of sycamore are located near by. The factories are usually located on the rivers and get their sycamore logs in rafts. The logs are placed in the water at different points along the streams, and are collected by a man with a power boat, who assembles them into rafts and tows them to the factory. Considerable quantities of sycamore are secured in this way along the lower Tennessee and Cumberland Rivers. Factories located on the lower Ohio River can usually get a sufficient supply for their needs. In other regions however factories seeking large amounts of sycamore are generally unable to get a sufficient quantity and have been greatly inconvenienced by lack of a steady supply. In most cases such factories have been obliged to a considerable degree to substitute other woods for sycamore.

Stand of Timber and Production

The wood is so widely scattered, and the compact bodies of it are so small, that any accurate estimate of the total stand is impossible. It is a bottom land tree, and is found generally along river banks and on islands. This choice of location is important, because it uses land otherwise unsuitable for cultivation, and the future supply is thus assured. Total reported cut has declined more or less steadily since 1909, but unfortunately the figures since that year are not accurate. In most recent years, the computed total cut shows a higher figure, approximating 1909 and for 1917, exceeding it. Thus the reported (U. S Govt.) cut for 1909 was 56,511,000 board ft.; the estimated cut in 1916 was 40,000,000 board ft., in 1917 62,000,000 board ft., and in 1918 35,000,000 board ft. The number of mills cutting sycamore approximated 3,000 in 1909 but dropped in 1913 and 1914 to nearly 600. Since then the number has increased steadily and now exceeds 900.

The price has varied little for 6 years, 1904 and 1907-1911 inclusive is averaged at $14 07, with the low $13.15 in 1904 and the high $14 77 in 1909 Taking this as a prewar figure, the figure for 1918 is $23.59, which is an increase of but 67.6 per cent, much less than the average hard wood. The amount produced in the various states has varied considerably in successive years, due partly to transportation changes, and partly to the irregularity of the stands, as noted previously.

Little sycamore is used in the rough, the principal part going to factories for the manufacture of various products. Forest service statistics for 1909 show more than 33,000,000 board ft. used in that year. Box and crate manufacturers used 51.42 per cent of this, or 17,131,693 ft., while furniture and fixture manufacturers used but 3,500,000 ft., vehicle and vehicle parts manufacturers only 63,600 ft., and ship and boat builders but 38,000 ft.

Boxes and Crates

Sycamore is favored for boxes to hold certain products which are easily contaminated by contact with most woods. It has long been the favorite wood for boxes for plug tobacco, which is easily stained and acquires an unpleasant taste and odor from many woods. It is considered the most suitable wood for this purpose, not only because of its non-contaminating qualities but also because of its moderate degree of strength and its attractive appearance. More sycamore is used for boxes for plug tobacco than for any other product. Tobacco boxes were formerly made of solid wood and were nailed together, and sycamore served well because it did not split easily. Now however they are commonly made of plywood glued together and lock cornered. Sycamore is well adapted for this also because it cuts well, makes a strong veneer and glues well.

Red gum has largely displaced sycamore for tobacco boxes in recent years, chiefly on account of the scarcity of sycamore. Red gum not only does not contaminate the tobacco, but has the added advantage of cutting into plywood more easily, and therefore faster than the sycamore. The gum splits more readily, but this difficulty is obviated by lock cornering in place of nailing. Red gum however does not make so attractive a box, and tobacco manufacturers have had considerable trouble in getting the trade to accept it because there was a suspicion that the grade of tobacco contained in the gum box was inferior. Sycamore is often used for the more conspicuous outer plywood pieces, but gum is being mixed with it more and more for such pieces, since the tobacco box makers often can not get a sufficient supply of sycamore even for the outside ply.

Furniture and Fixtures

The greater part of the sycamore employed in furniture and fixtures is in the form of plain sawed lumber. Much of it is manufactured into common furniture, such as is used for kitchens, pantries, porches and verandas. Slats for the backs of cheap chairs are made of sycamore. Large quantities of these chairs are made in the lower Ohio Valley. Elm and red gum are used for this purpose along with sycamore, because they all hold their shape well after they are steamed and bent. Light and dark pieces are kept separate and not used together in the same chair, since this detracts from its appearance. Factories making cheap chairs generally use much low grade material.

Since it does not impart taste, odor, or stain, sycamore is used for shelving, sides and bottoms of kitchen cabinets and for refrigerators. Of the total amount reported for this industry, 340,000 feet were used in the manufacture of kitchen furniture including kitchen tables.

Sycamore constitutes a not inconsiderable portion of the interior and hidden parts of more expensive furniture. It is very useful for drawer sides, backs and bottoms, shelves and pigeonholes, partitions and compartments, guides and linings. It is also used as core material on which veneer is glued. It finds place in such situ-

ations because it is not a high priced wood and not because of any superiority over many other woods used with it or replaced by it.

Quarter sawed sycamore for outside pieces is higher class material and is used for the same purpose as more expensive woods. Quarter sawing produces a different effect in sycamore from that in most of the oaks because of its dark colored medullary rays. The so-called "silver grain," which in oak is lighter than the rest of the wood, in sycamore is darker, producing a peculiar effect which is often admired. The quarter sawed stock is used in solid pieces and in the form of veneer, and is frequently made into panels. Sycamore is also cut into plain veneer for panelwork.

Sycamore in one form or another is used in practically all classes of furniture. A large demand comes from makers of bureaus, chiffoniers, bedsteads, folding beds, tables, china closets, music cabinets, bookcases and filing cabinets. Sycamore is also used for office fixtures and furniture, for which the quarter sawed wood is especially appropriate.

Striking Figure in Quarter Sawed Sycamore

The striking figure shown by sycamore when quarter sawed makes a demand for it for planing mill products, sash, doors, blinds and general millwork. Its principal use in this industry is for the interior finish of houses and stores, including flooring. It is also used in considerable amounts for cabinetwork. One of the most showy uses of quarter sawed sycamore is for mantels where panels, columns, brackets, shelves and tops are combined. Stair rails, newel posts, spindles, capitals and grillwork call for some of the best grades of this wood. There is also a demand for it for sash and blinds.

Sycamore is desirable for doors, casing and base. It is much in favor at the present time for door panels in the form of plain veneer. Sycamore panels of built up veneer are preferable to those of solid wood because of the tendency of the solid wood to warp and twist. Some figure can be obtained in the plain wood, but in order to get the striking figure effects peculiar to the wood it must be quartered. The sycamore door panel is said to go well with a pine frame, a birch frame or a frame veneered with sycamore.

Grading Rules

Sycamore lumber is graded under the National Hardwood Lumber Association Rules. There are separate classifications for plain and quartered sycamore. Lengths are from 4 to 16 feet, but not over 15 per cent of odd lengths are admitted. Thicknesses are ¼, ⅜, ½, ⅝, ¾, 1, 1¼, 1½, 1¾, 2, 2½, 3, 3½, 4, 4½, 5, 5½ and 6 inches. Widths are 3 inches and over.

Plain sycamore is graded under the same rules as beech, birch, hard maple and hackberry and the grades are as follows: Firsts, seconds, selects, No. 1 common, No. 2 common, wormy and No. 3 common. Inspection is made on the poor side of each piece. Firsts are 6 inches and over wide, 8 feet and over long, and pieces with 4 to 9 feet surface measure must be clear. Larger pieces can have one or two standard defects, depending on the size of the piece. Seconds are 6 inches and over wide, 8 feet and over long, and can have from one to five standard defects according to size of the piece. Firsts and seconds are generally combined as one grade and designated as "FAS." In this combined grade not more than 20 per cent of the pieces can be under 12 feet long and not more than 10 per cent of 8 and 9 foot lengths are allowed. Selects are 4 inches and over wide, 6 feet and over long, admitting 30 per cent under 12 feet long and 5 per cent of 6 and 7 foot lengths. In general pieces in this grade must be practically or nearly clear on the best face and the reverse side must be up to the No. 1 common grade. No. 1 commons are 3 inches and over wide, with not to exceed 5 per cent of 3 inch widths, and 4 feet and over long, with not over 30 per cent shorter than 10 feet and not to exceed 10 per cent of 4 and 5 feet lengths. Pieces 4 and 5 feet long, and 3 and 4 inches wide 6 and 7 feet long must be clear. Larger pieces must work 66⅔ per cent clear face in not over 2, 3 or 4 cuttings depending on width and length of piece with specified minimum sizes of cuttings. No. 2 commons are 3 inches and over wide, 4 feet and over long, with not more than 10 per cent of 4 and 5 feet lengths admitted. Pieces must work 50 per cent clear face in not over 3, 4 or 5 cuttings (not less than 3 inches wide and 2 feet long) according to size of piece. In wormy grade pin-worm holes are not considered a defect, and it is a combination of all grades included in No. 2 common and better. No. 3 commons are 3 inches and over wide, 4 feet and over long, and each piece must contain at least 25 per cent of sound cuttings of a minimum width of 1½ inches and a minimum area of 36 square inches.

The grading rules for quarter sawed sycamore are the same as for plain sawed except that the combined grade of firsts and seconds and selects must show figure on one face not less than 90 per cent in the aggregate and the cuttings in No. 1 common and No. 2 common must show figure on one face. There is a slight difference also in the grade No. 1 common, the rules for plain sycamore allowing a large number of cuttings in the largest pieces.

Summary and Conclusions

Although neither a high priced nor a plentiful wood, sycamore is well regarded for certain uses. It is particularly in demand for such containers as slack barrels and plug tobacco boxes because it does not impart stain, taste or odor, has a clean and pleasing appearance, is fairly strong, and works and seasons well. Quarter sawed material is desirable for the outside finish of various products.

There would be a good market for sycamore if a sufficent and constant supply could be assured. However on account of the occasional occurrence of the timber the supply is irregular, and recently there seems to have been less of it available than in former years. Red gum is being substituted for sycamore to a very large extent for tobacco boxes and slack staves, and with improved methods in working and seasoning has proved satisfactory to a degree, although it does not present so good an appearance.

There will probably always be considerable though occasional supplies of sycamore available, since the tree occupies flood lands and areas along the streams not suitable for cultivation. Although many other trees are worth more in the market, sycamore is valuable to the agriculturist along streams for keeping his land from washing, and its growth should therefore be encouraged in such situations.

Modest-Cost Butcher Body for 1-Ton Chassis

IN many small towns the butcher still goes around from door to door, selling his meat to his customers in person and cutting it as wanted. With a horse-drawn wagon, this is such a slow process that he can scarcely see enough people each day to make a good living. That is the process of peddling to call it by its right name, is sufficiently slow in itself, but added to this a slow method of transportation from customer to customer simply makes the situation impossible.

The average tradesman has some form of a car for recreation on week ends and holidays, and it should be a simple matter for the ambitious body builder, says Blacksmith and Wheelwright, to induce the butcher to have a suitable body built for use on his touring car chassis, thus making it do double duty. Incidentally it may be pointed out that the horse and wagon can be sold for a considerable sum towards the new body, while the increased business resulting from the more modern and quicker method of transportation will soon return the balance of the cost, and make the business permanently more profitable to him.

The butcher carries his meat in the wagon, goes from door to door, takes his orders, cuts off the meat right in the wagon and delivers it to the housewife without any more ado. Sounds simple enough. Many times however the butcher labors under difficulties for often he has not the facilities for serving his customers properly, and wastes a lot of time with unnecessary motion. Here is where the wagonmaker steps in. We'll wager that when any progressive butcher sees the drawings below, it'll just make his mouth water and he'll say: "How much?"

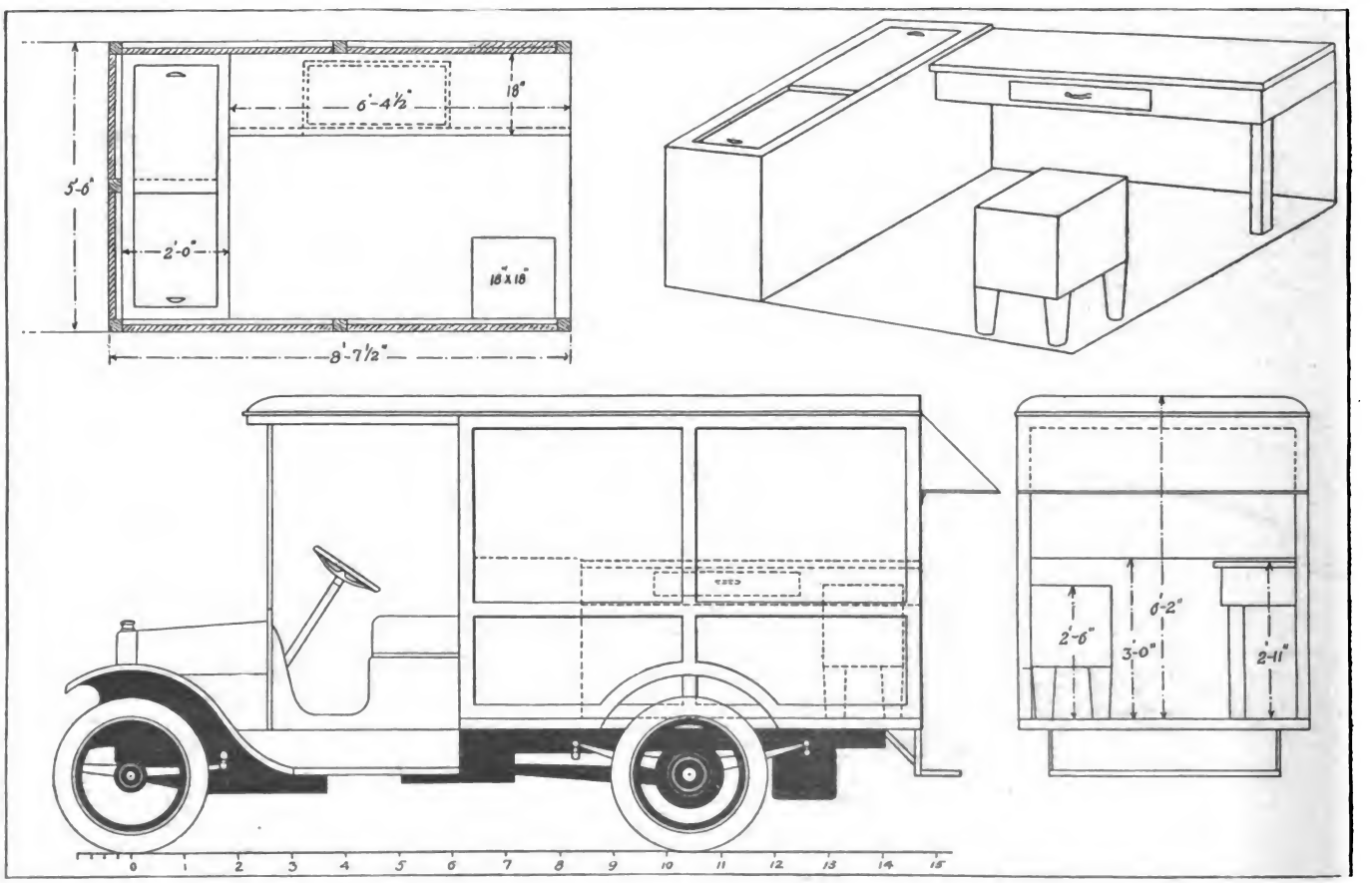
The body is to be placed on a Studebaker 1 ton truck or similar chassis and is made of hard wood stock throughout. It has four ⅞ in. panels on each side as well as the front of the body. The top of the body is made up of twelve ⅞ in. bows, with ¼ in. top strips running lengthwise. There are three upright side posts on each side, made of 2 in. by 1½ in. stock. The top bars, lower base bars and center strips are of the same stock.

The flooring sills are made of 2 in. by 5 in. stock and three floor boards of 1¼ in. stock. The ice box at the forward end of the body is of the ordinary type seen in fish stores, having two sliding top doors, one sliding over the other.

The counter which can be used for cutting the meat, packing it, etc., has a drawer at the center which will be found useful for keeping sharp knives, and other weapons of the butcher's art.

The chopping block is of the ordinary 18 by 18 in. type. At the forward end of the body over the ice box hooks can be placed on which saws, cleavers and meat hooks can be hung. At the side of the body over the counter, hooks can be placed from which bacon strips, hams, etc., can be suspended.

The rear of the body is all dressed up with a small awning which is provided to keep the inside as cool as possible and protect the butcher from the glare of the sun.



Drawings for a traveling butcher shop on Studebaker 1-ton chassis. Lower left—General side view. Lower right—Rear view with dimensions. Upper left—Plan showing layout. Upper right—Perspective of ice box, chopping block and table

Patent Office Conditions Menace American Industry

By EDWIN J. PRINDLE*

Insufficient Force and Meagre Salaries—Raised but 10 Per Cent Since 1848—Menace American Manufacturing Supremacy, and Through it, American Standards of Living

AMERICA'S position as the leading country of the world in manufacture and the production of inventions is due, more than anything else, to our patent system. Americans are not naturally more inventive than Europeans, for we are all either Europeans or decendants of Europeans. We have great natural resources but so have other countries. The only tangible reason which can be pointed out for the so common existence in this country of the power to invent is that it has been developed through seeking for the rewards held out by the American patent system.

As a single good example of what the American inventor has done to increase our wealth and reduce the cost of labor, the changes which he has wrought in agriculture may be taken. Before the establishment of our patent system, the art of agriculture had remained practically at a standstill for many thousand of years and was conducted almost wholly by manual operations. The American inventor has provided the farmer with so much more efficient tools and with so many automatic or semi-automatic machines that it is a very conservative estimate to state that one man today can do with them the work of from 10 to 15 men with the tools available at the time of the Declaration of Independence. While the farmer of the Revolution did most of his work by the unaided use of his hands, the farmer of today works through his brain with machinery which he has only to guide and watch, and which even saves him the trouble of walking This marvelous change, in but one hundred and twenty-five years, in an art which had stood still so long, is due wholly to the American patent system. Think where the allied countries would have been during the war, and would be today, if the American farmer were only able to produce at the rate at which he was producing before our patent system brought forth these inventions. Untold millions would have perished from starvation or would now be starving, not for lack of money, but for lack of food at any price. What is true of agriculture is equally true of many other arts and industries in our country.

American Patents Practically Guaranteed to be Valid

Aside from the right granted to the inventor, in exchange for a disclosure of his invention, to monopolize the child of his brain for 17 years, which he might have kept secret and so might possibly have monopolized for a much longer period, although less advantageously, the principal attraction of our patent system has been the provision of an examining force in the Patent Office, whose duty it is to make a search of all the patents and publications of the world and of the state of unpublished knowledge in the United States before granting the patent, to determine whether the invention is new, so that when the inventor receives a patent there shall be a very strong probability that the patent is valid. The granting of patents under such circumstances raises a legal presumption that the patent is valid and puts the burden on the infringer of proving that the patent is not valid. This presumption greatly enhances the salability of our patents. Without it there would be produced but a fraction of the number of patents now produced, and we would surely lose our lead over other countries in inventing and ultimately in manufacturing. Let the American inventor once fully get the idea that it is not worth while to invent, and it would take a generation to rebuild a class of inventors after the mistake was realized.

No ordinary cautious business man would be likely to purchase a patent without having such an examination made, either by the Patent Office or by attorneys employed at his own expense. As there are over 1,350,000 U. S. patents and several million foreign patents, to say nothing of the enormous amount of technical literature, which should be considered, the making of such a search requires a great deal of technical knowledge and skill.

The Patent Office has classified about half of the patents, so as to simplify the searches, but it will be a generation before the classification is made complete if it proceeds only at the rate which the present limited force permits.

Outside Patent Search Very Expensive

The expense of a search to determine whether a patent is valid, when made by attorneys outside of the Patent Office, is unavoidably so high that individuals who might otherwise purchase a patent are frequently deterred from purchasing on account of the expense, and in many instances even manufacturing concerns would refuse to buy a patent rather than incur the expense of a search thus made. Where inventors would like to exploit their own inventions, if there were no examination system within the Patent Office, they would not usually think it worth while to make the invention, because the expense of a search through attorneys, added to the expense of developing the invention, frequently would be prohibitive. On the other hand, a sufficiently large and properly qualified examining force in the Patent Office would be able to make good examinations, or reasonably certain examinations, at a cost which would enable the Patent Office also to print and issue the patent for a total uniform charge of $40 to $45 per patent. This is because by great subdivision of the labor, each examiner would be enabled to work on a particular class or subclass of inventions for years, which would enable him to become so familiar with that class and with the limits within which it would be safe to confine his examination that such an examination would consume very much less time then if made by persons whose successive searches necessarily related to inventions in many different classes and arts, as must be the case with attorneys.

For many years the Patent Office has been getting farther and farther behind in its work of examining applica-

*Chairman of the Committee on Patents of American Engineering Council, representing the A. S. M. E. Printed by editorial courtesy, Mechanical Engineering.

tions for patents. The number of applications for patents has been steadily increasing for many years, until now over 100,000 applications are received in the Patent Office each year, including those for trade mark registrations, the number of applications having increased 36 per cent in the last three years. Every patent granted in this or in other countries adds to the field of search which must be gone over in examining later applications for patents. The examining force has not been increased in proportion to the increase in work. The result has been that the Patent Office has gradually been losing more and more the race with its work, until today an inventor frequently has to wait a year before receiving the first action from the Patent Office in his application, which he has to await before he can begin the series of arguments and amendments usually necessary to overcome or obviate the objection of the Patent Office and obtain a patent If the inventor has made arrangements for capital, this delay may cause loss of interest of the proposed investors in the enterprise or the diversion of the proposed capital to other enterprises, and may be just as serious for him as the refusal of a patent altogether.

Lack of Examiners Increasing Litigation

The entirely insufficient number of examiners in the Patent Office in recent times unavoidably results in the granting of many patents which are partially or wholly invalid. Many of these patents when finally found to be invalid, have resulted in heavy losses of time and money on the part of the inventor or those engaged in exploiting the invention, and they frequently become the cause of long, expensive and fruitless litigations, which not only mean large losses to those interested in the patent, but heavy expenses to the manufacturer who has to resist the suit. These suits, taking as they do the time of the courts, put the public to large expense. Thus a little money is saved in the Patent Office and a great deal of money is lost in private and public expenditure in consequence.

The positions in the examining corps of the Patent Office ought to be very attractive to a fine class of men. The examining corps has a record for the strictest honesty that is unexcelled by the judges of any state or county, or by any organization of men to whom are entrusted most valuable secrets. The primary examiners (who are the chiefs of divisions) are in effect the commissioner of patents in 97 per cent of the cases for there is no appeal from their favorable decisions on applications for patents, and their final unfavorable decisions are accepted in most cases, because of the expense of appeal from them. They pass upon inventions often of very great value, and their positions, if they were adequately compensated, would because of the dignity and security attached to them, be attractive to men of high qualifications and ability.

University Education a Necessity

Today however the pay is so inadequate that an educated man can barely eke out an existence. Men without a college education, or the equivalent thereof, could not pass the examinations for positions on the examining force, and yet owing to the present meagre compensation, examiners are unable to send their own sons to college. Many of the best examiners have been forced to resign and go into the private practice of patent law, where at the outset, the average compensation—of primary examiners, for instance—from patent lawyers or large corporations, is considerably more than twice their Patent Office salaries, with the certainty that they will earn progressively more, if they prove capable. It has become a common practice for men to go into the Patent Office for two or three years' experience, with no intention of staying, but only to get sufficient experience so that they can enter the employ of patent lawyers or the patent departments of large corporations. Thus the Patent Office is to a large extent, merely a training school for patent lawyers. Today examiners receive but 10 per cent more than the pay fixed for their positions in 1848. Then their pay was equal to that of members of Congress and of United States district judges whose salaries have been increased 300 per cent or more since that date.

The resignations from the examining corps have for ten years been going on at the rate of 25 per cent per annum, and today over 10 per cent of the examiners are temporary appointees, who are qualified to pass the rigid scientific and technical examination necessary for a regular appointment. As it takes at least two or three years for an examiner to become sufficiently familiar with the class of inventions to which he is assigned to be efficient in his work, the frequent rotations due to the constant stream of resignations results in many of the classes of inventions being examined all of the time by men inefficiently familiar with them.

System Now Near the Breaking Point

The Patent Office is now so far behind in its work that it cannot go much farther without breaking down. The situation is so serious that the National Research Council, at the request of the Secretary of the Interior and the Commissioner of Patents, appointed a committee to investigate it and propose a remedy. This committee was composed of eminent inventors and scientists and three patent lawyers, namely Dr. W. F. Durand, professor of mechanical engineering at the Leland Stanford University, its first chairman; Dr. L. H. Baekland, now chairman, inventor and scientist; Dr. R. A. Milliken, professor of physics at the University of Chicago, and an inventor; Dr. M. I. Pupin, professor of electrical engineering at Columbia University, and an inventor; Dr. Reid Hunt, professor of medicine at Harvard University Medical School; C. P. Townsend, a consulting chemist of Washington, and three patent lawyers, Thomas Ewing, formerly Commissioner of Patents; Frederick P. Fish of Boston, and the writer.

Provisions of Nolan Bill

After most careful investigation, this committee prepared and secured the introduction into Congress of bill H. R. 11,984, known as the Nolan Patent Office Bill, from its introducer, Hon. John I. Nolan. This bill proposed increases in the examining force of the Patent Office of 6 per cent and the clerical force of 4 per cent and increases in the salaries. Taking the position of primary examiner as typical, the increase in salary was from $2,700 to $3,900. There is the following evidence, from thoroughly qualified organizations, that the proposed salary for primary examiners is the lowest that can possibly remedy the present situation: A questionnaire sent out by the American Patent Law Association showed that the average annual income of primary examiners, who have recently resigned from the Patent Office and have gone into the employ of patent lawyers is $6,400.

The Engineering Council, composed of engineers and representing 45,000 engineers, passed a resolution stating that the salary of $3,900 for a primary examiner was low by comparison with salaries of engineers outside of government service, of whom similar responsibilities and qualifications were required to those of primary examiners. The American Engineering Council, under the presidency of Herbert Hoover, has succeeded to the work of this council and through its patents committee is actively forwarding the movement for Patent Office reform. The American Society of Mechanical Engineers is actively interested in the immediate betterment of Patent Office conditions.

The National Association of Manufacturers, representing 5,500 manufacturers, many of whom are employing engineers, passed a resolution stating that the relief provided in the Nolan bill as it passed the house of Representatives (in which form the salary of the primary examiner was $3,900) is the minimum that should be provided.

The American Chemical Society, composed of 13,500 chemists, passed a resolution urging the restoration to their original values of the numbers for the examining and clerical forces of the Patent Office and the salaries therefor in the Nolan Patent Office bill.

Resignations and Confusion Continue

The resignations from the Patent Office have continued uninterruptedly at the same rate during the pendency of the Nolan bill. This bill passed the house of Representatives without amendment. The Senate has amended the salaries to the principal examiners and clerks to such an extent as to make the bill wholly inadequate for the present situation. It decreased the salary of primary examiners to $3,600. This figure is shown to be inadequate, not only by the evidence above referred to, but also by the fact that the prospect of the bill becoming law with this salary in it has not in the least stemmed the tide of resignations.

The Senate and House both referred the bill to a conference committee to adjust their differences. Representatives of the Federated Engineering Council and of many organizations represented therein, representing over 80,000 engineers, appeared before the conference committee at a hearing held the first week in January, which was also attended by representatives of many other organizations, and urged that the figures of the bill be restored to the condition in which they passed the House of Representatives and that the bill be immediately enacted into law.

Although this is a time for great economy, it would be false economy to deny the Patent Office the moderate measure of relief provided in this bill. It is because American inventors are constantly improving and cheapening our processes of manufacture and devising automatic machinery to replace labor, as well as producing inventions to serve new purposes never before accomplished that we have been able to maintain our great prosperity and pay our workmen wages that enable them to enjoy the highest scale of living of any country and to successfully meet foreign competition, while at the same time conferring benefits on the entire world.

With our patent system working normally, many inventions will be produced every year, which in the aggregate, will add so much to the income of our country that the returns from income taxes will be much larger with the Patent Office properly supported than without it. Therefore to deny the Patent Office the needed relief would not be an economy but a waste.

European countries have been taught by the war to be on the tip-toe of efficiency, and they are already strengthening their patent systems. We must maintain our patent system in efficient operation or we shall ultimately lose our advantage over other countries, and will also have to reduce our scale of living to theirs.

Moreover the Nolan bill provides the funds for its own increases of expenses by an increase in the fees charged for obtaining a patent from $35 to $45. The Patent Office is and always has been more than self-sustaining. It has now a credit on the books of the treasury department of over $10,000,000 that has been denied to the Patent Office and turned into the general fund. The Patent Office should have the proposed relief and have it quickly.

Building the Small Car and Body

(Continued from page 17)

putting on the door pockets and placing the mats on the floor.

At the cutting tables were long rolls of the artificial leather covering being marked according to pattern, and backs and cushions for the "Four-Ninety" were cut with swift electric knives. Once cut, the girls made short work of the sewing operation, preparing each back and cushion for the layers of hair. Expert operators then put the hair in place, set the cushions in large hydraulic presses and in the twinkling of an eye, complete backs and cushions were stuffed, buttoned and formed in the attractive, tufted style.

It is also the duty of the trimmers, after they have made the tops, including frames and covering, and the top covers, to adjust these to the body and to attach top brackets. When all these parts have been put into place the windshield is fastened to the dash and the body as a separate unit is complete.

Meanwhile the chassis has been traveling along the endless chain conveyor on a lower floor of the plant. It has been progressively constructed by equally specialized mechanical workers until it has reached that point where it is ready for body to be attached. The building of both chassis and body is so well timed in Chevrolet plants that each is ready for the other simultaneously. At just this stage the finished body is lowered through a hatch directly over the moving chassis and fits so nicely that it is only necessary to fasten one unit to the other. This done, wiring system is connected with motor, rear fenders attached, steering wheel adjusted and hood set in place. As all these connections between the two are effected the complete and perfect car arrives at end of its course.

They use what is called "progressive assembly" at the plant. That is, the cars are carried on an endless chain conveyor, which begins where the frame is constructed and moves (at rate of 100 feet in 45 minutes) until the final screw is in its place, the oil and water and gasoline put in, and the car announced complete and perfect, ready for the purchaser.

During this process of assembly one sees first a crew of workmen putting the front and rear springs and axles on the complete frame; another crew then lowers and

(Continued on page 28)

The New and Unusual in the Automotive Field

Turn-O-Stop Rear Signal Gives Warning of Either Turn or Stop—Kwik-Way Valve Facing Machine Refaces Valves Preparatory to Grinding—Smith Standard Radius Tools Cut Concave or Convex Radii

Automotive Manufacturer will present on these pages some automotive unit, accessory or equipment which presents unusual and different features

Turn-O-Stop Rear Warning Signal

A new form of rear warning signal, to indicate the movements of an automobile or truck, has been perfected and is now being placed on the market by the Turn-O-Stop Mfg. Corp., through Mitchell & Livingston, New York, N. Y. This includes a pair of lamps which are generally placed on the rear fenders, one on either side. By means of suitable connections, when the driver intends to come to a stop, slow down, or turn in either direction, he moves a finger lever on the steering post. This gives the desired signal on the rear lamps, Fig 1, one or both as the case may be.

When the driver wishes to turn to the right, he moves the finger lever shown in Fig. 2, to the right. Then the right hand rear signal snaps open, flashes out a white hand against a red background, flashes the warning letters

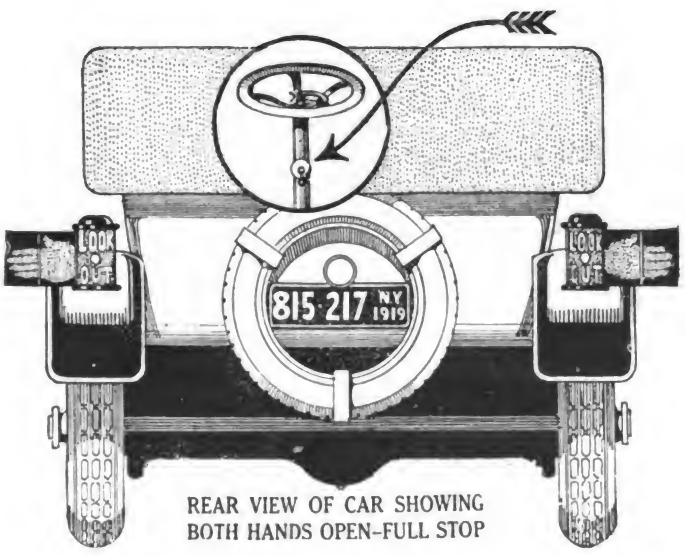


Fig. 1. Rear view of car with Turn-O-Stop Signals in position

Look Out, also in white against a red background, and emits a buzzing sound. The white hand and words are indicated by means of an internal electric light. The buzzing sound can be heard, it is claimed, within a radius of 100 ft.

For a left hand turn, the finger lever is pressed to the left, and the left rear signal performs in a similar manner. For a full stop the lever is pressed downward, when both signals snap open, as indicated in Fig. 1. The buzzing sounds continue as long as the signals are on, so that the driver is protected against running with signals set. The lever can be removed like a switch key, so that the signal system can not be trifled with in the owner's absence.

Complete outfit includes two lamps, cable connections, switch key, bolts, wire, etc. Signals are handsomely finished, are dignified in appearance, and are built to outwear the life of the car.

Kwik-Way Valve Facing Machine

A new machine has been developed for trueing up the face of automotive motor valves with relation to their stems. The importance of this cannot be overestimated, for without it the valve can not be a perfect fit, regardless of the accuracy of the valve seat in the cylinder block. This new machine, shown in Fig. 3, is known as the Kwik-Way, and is made by the Cedar Rapids Engineering Co., Cedar Rapids, Ia.

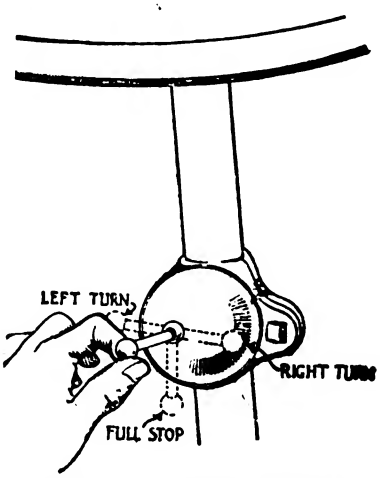


Fig. 2. Turn-O-Stop operating lever on steering post

In this machine the valve is held by an especially designed chuck and rotated while the face is being trued up with a high speed grinding wheel. The chuck shaft, grinding wheel and motor are mounted on a symmetrical cast iron base. Electric current may be obtained from any lighting circuit.

This machine will take any size valve up to and including 3 in. head and ½ in. stem. By means of a graduated dial it can be set to grind valves at any angle from 25 to 65 deg. The dominant features of this machine are accuracy and speed.

Fig. 3. Kwik-Way Valve Facing Machine with valve in position

While designed as a tool for garages and repair shops, its utility is none the less desirable to manufacturers since its use would insure motors starting out with perfectly true valves and valve seats, a combination which almost guarantees maximum power, fuel economy and other desirable qualities.

Smith Standard Radius Cutting Tools

In lathe, planer and shaper machine work, it is often necessary to cut a radius, either concave or convex. This generally requires a special formed tool, or at least it has in the past, but a new tool has been developed which will do this work instantly. Obviously, this saves much time and labor, produces an accurate result, and in this way, turns out absolutely interchangeable parts despite the radius The tool referred to is known by its maker, R. C. Smith Tool & Mfg. Co., Newark, N. J., as the Standard Radius Tool. It is made in single tools, and in sets. Thus Fig. 4 shows a convex cutter turning a ½ in. concave radius on the right end of the piece in the lathe. The second illustration, Fig. 5, shows the Standard Set No. 1. As will be noted this ranges from 1/16 to 1 in. radii, in 15 steps, and a 60 deg. cutter. This covers the average machine shop requirements, but set No. 2, not shown, is more complete, having in addition 5 concave cutters ranging from ½ to 1 in. Set No. 3, not shown, is even more complete including 9 concave cutters for the smaller radii, from 1/16 to 7/16 and 9/16 in.

Fig. 4. Smith Standard ½ In. Radius Cutter at work

Each set includes a patented holder, the standard shank size of which is ½ by 1⅛ by 6¼ in., and a wrench for clamping the cutter firmly in place by means of the lock screw. Other shank sizes will be made specially, at an extra charge.

With this tool when it is desired to cut a ¼ in radius, the mechanic simply inserts a ¼ in. Smith cutter in the holder, puts this in the machine, and proceeds with the work. There is no delay, no fiddling around, nothing special to be made or figured out. Special sizes of cutters will be made to order.

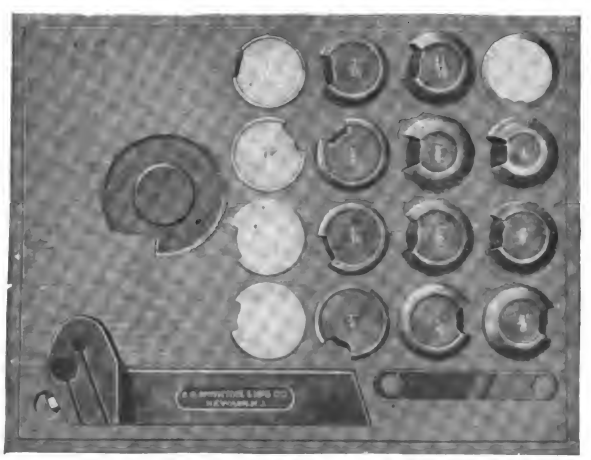


Fig. 5. Smith Standard Radius Cutters in Set No. 1 complete with holder

Possible New Materials for Paints

(Continued from page 9)

style, consisting of large logs between which the mats are set, and a large wooden ram forces the mats together, pressing out the oil. The oil is then filtered through bamboo cloths and is then carried to the China wood oil broker in large baskets, the baskets being lined with a peculiarly oiled paper. Each Chinaman carries four baskets, two being suspended from each of two sticks swung across the shoulders. Each basket of oil which is purchased is tested, and its richness determined. The oil is then emptied into tanks and from these tanks is drawn off into barrels, in which it is shipped to varnish manufacturers.

This wood oil is one of the most important native products of China. In the United States it is frequently called nut oil because pressed from a nut, but in China it is known as wood oil because used mainly on wood. It is obtained from two varieties of tree, one of which is confined largely to southern China, while the other flourishes in western and central China. The latter is far more important and furnishes the major part of the oil exported. Both species are hardy trees and grow luxuriantly in a hilly country up to an altitude of 2,500 feet. They seem to thrive in poor soil and are able to withstand long periods of drought; they are found as far north os 24° latitude, but in such a severe climate fail to bear fruit on account of the cold. A full grown tree is about 20 feet in height and the trunk measures 6 to 12 inches in diameter. The "tung yu shu" tree is deciduous and sheds its leaves in October and November. It is low spreading, and in the spring produces a great profusion of white blossoms and flowers, the petals of which are sprinkled with pink and yellow. The fruit of the tree is about the size of a large walnut, in shape not unlike a persimmon, with a smooth exterior and contains from 3 to 5 seeds. When ripe the husk bursts open and the seeds or nuts fall to the ground.

Transportation of Oil to Hankow

The oil is generally bought up by dealers in cities or interior market places and held for speculation. It is with these dealers, or in some cases the mill owner, with whom the compradore of a foreign firm has to deal. When a shipment of wood oil has been purchased by the compradore it is placed on board a Chinese junk for transportation to Hankow. Each junk holds from 300 to 700 baskets, which are lined with layers of varnished paper. En route the cargo is liable to taxation in various forms by the numerous military officers through whose territory it passes.

Over 60 per cent of the wood oil entering Hankow comes from Szechwan or Kweichow and has to pass through the Yangtze gorges, where many cargo boats are wrecked. Since the foreign manager in Hankow buys his wood oil from the compradore he prefers that the compradore take these risks, and consequently only pays for pure oil laid down in his godown at Hankow. Insurance rates on junks making the trip from Szechwan to Hankow are prohibitive. Some companies send small lighters into Hunan in order to tow carbo boats loaded with wood oil purchased in that province. Others buy their oil from Chinese dealers in Hankow who have bought cargo in the interior.

(To be continued)

Building the Small Car

(Continued from page 25)

adjusts the engine into place, and the gas tank, then, as the car moves slowly on, the brake and steering rods are added, the transmission and the brake rods.

Let us pause for a moment and watch the enameling of the chassis which is the next operation. The work is done with an air brush, which really means that the paint is sprayed on, as one might do with a garden hose. It makes a heart of economical trend skip a beat or two to contemplate the amount of enamel that is so efficiently applied to Chevrolet cars here every day.

The hood and fenders, instead of being air-brush painted as the chassis is, are dipped into the enamel and swung on frames to drip before being baked.

The baking process takes place in hige ovens especially constructed for the purpose.

As the chassis moves out from the first oven and continues on its road to completion, it is equipped with the finished body, lowered from the floor above and then the tops are fitted into place, adjustments made, and at last the car finds itself in the final test room.

And at last when everything has been carefully tested, the Chevrolet is loaded on a flat car on a switch just outside the final test room where it joins five other cars and begins its transit to some waiting dealer—and customer.

There are many special departments in the plant which interest one. The welding for instance where red hot irons and flying sparks make you think of the blacksmith shop of yore, now almost entirely succeeded by the garage; or the room where the bodies are built.

One special department with much of interest is that in which the camshafts are made. The importance of this part in engine performance may be judged from a consideration of the fact that it governs the opening and closing of the valves, indirectly the sparks, and thus the explosions. Consequently a very accurate camshaft of suitable material is a necessity in the smooth even flow of power.

The Chevrolet camshaft is a drop forging of high carbon steel, heat treated. The integral cams are especially heat treated and their surfaces so finely ground as to come within limits of five one-thousandths of an inch.

These cams are made oval in shape so as to raise and lower the valves with a gradual movement, thus insuring great quietness and long wear.

The diameter has been accurately calculated so as to avoid any deflection of the shaft while lifting the valves and the three ample bearings on which it is supported are so finely adjusted that balance is assured. All this involves numerous delicate operations and inspections during the course of construction before the camshaft is finally passed and installed as a unit in the power plant.

Fig. 13. Grinding cams and inspecting progress of camshaft finishing

And these operations are progressive. After the manner of all Chevrolet manufacturing processes, they have been so arranged that each follows the other in logical order. Time and labor are so conserved and directed that the greatest efficiency is secured. Modern machinery is used whose capacity is especially calculated for the work and special conveyors carry the part from one operation to the next.

When it starts on its way through the plant, the camshaft looks like a tough piece of knotted wood. But all irregularities of the rough forging are removed by snagging on an emery wheel before it is placed on any of the machines which do their part in perfecting the finished piece.

After this operation it goes to a sharp-tooled milling machine that cuts the ends to exact dimensions. This done, the cams receive the first rough grinding, Fig. 13, and the whole is straightened by finely adjusted air presses. Then the cams themselves and the bearings are turned, the cams are rough ground and the shaft is ready for the heat treatment.

All these operations are performed before the treatment by heat and brought to a fine point of accuracy. For once a piece of steel is hardened in the heat treat department, it is so hard that only the most costly cutters and millers could shape it without damage as much to themselves as to the cams. To the heat treatment is due the quality of the metal itself.

Fig. 14. Building the Chevrolet frame. As shown it is inverted

Fig. 15. Camshaft inspection includes each bearing, cam, other dimensions and quality of steel

In the first place it should be remembered that the character of steel can be controlled by the amount of carbon used. The wrought iron, of which steel is made, absorbs carbon as water does sugar. The degree in which carbon is applied determines the degree of strength and character whether hard, soft, tough or brittle.

In the Chevrolet heat treat department the amount of carbon and the manner of its application have been scientifically adjusted to the work the camshaft is called upon to do. During the carbonization of the camshaft, the cams and bearings are left so exposed as to acquire hardness in just the proper degree. As soon as this carbonizing process is finished, the camshaft is tempered in oil in order to fix the effect of the carbon permanently.

Then the camshaft is balanced, Fig. 12. This is a trade in itself, applied by men who practice it for years to secure the finest degree of accuracy. The shaft is suspended on knife-like rollers and revolved; and at any point where the gauges show it out of alignment in the slightest degree, it is straightened in a delicate press.

From this point the camshaft progresses through a series of grinding operations. Each of the three bearings and the gear fit is ground separately, and each is ground twice, once to secure exact dimensions and once to perfect the finish on each bearing surface. The whole course of these operations requires eight different sets of machines, one for each operation.

The grinding of the cams is especially interesting. Their eccentric shape requires an eccentric motion of the grinding machine.

To insure the accuracy of this operation, the rotation of the grinding wheel of the machine is controlled by a master cam. This is under continuous observation by the operator of the machine itself, and also an inspector, and the master cam can be removed at any time and gauged in turn by the master camshaft. The master camshaft is the pattern piece, never used for any other purpose than the adjustment of master cams and must be perfect in every particular.

After every operation in the construction of the camshaft, the work done is carefully inspected, Fig. 15). Every error or defect is detected as soon as it occurs and no piece of work that is not perfect can pass on to the next operation. But when all operations are complete, there is a final inspection, when every bearing, cam and dimension of the camshaft as well as the quality and character of the steel is inspected in detail. For this purpose, scleroscopes, micrometers and other scientific gauges are used, and before it is finally passed as approved, the camshaft must comply accurately and in every particular with the high standard set by the specifications.

No matter how good the design and workmanship, the finished car will not be right unless all the materials, especially the steels, are right. In this particular car, 100,000 tons of steel are used each year, so the task of checking up or proving this material is no small one. It requires a special department, included in which are chemical and physical laboratories. These too are departments of great interest.

Upon the quality and the suitability of the steel used in these parts important things depend. It is responsible in great measure for the strength, for the long wearing qualities which have always distinguished the Chevrolet. It is responsible for the comfort and for the safety of passengers. The medium weight design that makes possible its unusual economy of operation, is based on the strength of the highest grade steel.

Steel, as everyone knows, is developed from wrought iron. No matter how much this is hammered and rolled, heated or cooled, it is still iron. But molten iron has the remarkable property of dissolving carbon in pretty much the same way that water dissolves sugar. It does not dissolve very much—7 pounds at the utmost is all that 100 pounds of iron will take up. But even 1/10 of a pound of carbon is sufficient to cause a radical change in 100 pounds of iron. It looks like an entirely different substance. It can be made hard and brittle like glass, or soft and tough like wrought iron, and at the same time its strength has increased enormously. It has become steel.

As soon as the possibilities of this product first became apparent, innumerable experiments were begun to adapt its strength for untold uses. As a result of these it was found that not only varying quantities of carbon would affect changes in it, but that its strength could be increased and controlled by the addition of still other substances.

Each of these substances gives the steel a special character. Manganese, for instance, makes it both harder and tougher. Chrome and nickel increase its strength and especially its resistance against shocks. Tungsten makes steel suitable for tools that are worked at such high speeds that the steel is liable to get hot. It makes so-called high speed steel.

But all these steels have one thing in common, namely, that they are very sensitive to heat. By heating steel carefully to a certain temperature and then cooling it again—quenching—it is possible to develop the properties in such a way that the steel is most suitable for the purpose intended.

This process is consummated in the "bakeshop" or heat treat department as it is officially known. Here are a number of ovens that remind one somewhat of those in an ordinary bakery. But they are most scientifically constructed, fired with fuel oil, and equipped with all manner of instruments—such as pyrometers and poxentiometers for supervising temperature.

But it should be understood that the correct treatment of steel depends entirely on its chemical composition, its size and shape and the qualities to be developed in each individual case. Therefore it is in the laboratory where the entire process is controlled that the most interesting part of the work is carried out. And in the Chevrolet factory the most scientific apparatus has been installed for making a complete quantitative analysis of all steels treated, Fig. 11.

There for instance are to be found among other things a Brinell machine and what is known as a scleroscope, both for the purpose of testing the steel's hardness. There also is a great physical testing machine which makes it possible to control the tensile strength of steel by subjecting a suitably formed piece of known dimensions to a constantly increasing load until it breaks, and then measuring the amount of the load. Probably the

It is this careful and constant application of knowledge and experience that insures the quality of all steel. It is just an instance of the thoroughness in every detail of their manufacture that makes Chevrolet cars so dependable.

MEN OF THE AUTOMOTIVE INDUSTRY

Who They Are What They Are What They Are Doing

W. J. Corr has been elected secretary and treasurer of the Maibohm Motors Co., Sandusky, O., succeeding I. O. Borman, resigned. Corr has been director of purchases for the Maibohm company for the past year and is widely known in the automotive industry. He was with the General Motors for the first two years following its organization, doing purchasing, cost and systematizing work at the Northway, Cadillac and Oakland plants. For the following two years he was director of purchases of the Apperson Brothers Automobile Co., then for two years director of purchases of the Falls Motors Corp. For nearly three years prior to joining the Maibohm organization he was purchasing agent for the Detroit plant of the Aluminum Castings Co.

Homer Hilton, former sales manager of the Oshkosh F. W. D truck, has been sent to Detroit to take charge of the office of the National Association of Truck Sales Managers, pending the selection of a successor to H. D. Dabney, secretary, whose resignation will become effective March 15. A committee from the association now is in communication with several applicants for the position and announcement of an appointment is expected shortly. Hilton, who is one of the best known members of the association, will spend a month or two in the local office inducting the new secretary before assuming other duties.

Thomas F. Baxter, at one time general manager of the Holt Manufacturing Co., Stockton, Cal., and since the death of Benjamin Holt, president of that organization, has severed his connection with the firm of Bond & Goodwin, Boston, Mass., with which he was also identified for some time. The business of the Holt organization has grown to such an extent as to require Baxter's undivided attention and although formerly a citizen of West Newton, Mass., he will continue to reside in Stockton, where he may better superintend the company's affairs.

Percy Bloxam of Great Britain, a member of the Institute of Mechanical Engineers and for some time managing director of Cambridge Engineering & Motor Co., Ltd., formerly one of the chief inspectors for the British government in their automobile and gun and carriage section, has joined the Anderson Motor Co., Rock Hill, S. C., as superintendent and engineer. Mr. Bloxam is well known in the engineering world having had connections with some of the largest engineering concerns in England.

K. T. Keller has been appointed manager of manufacturing of the Chevrolet Motor Co., succeeding F. W. Hohensee, who resigned to join the new Durant Motors organization. Keller has been in the General Motors organization since 1911, having served as superintendent at the Northway Motor & Mfg. Co., general superintendent at the Buick Motor Co., and as a member of the production operations staff at the corporation offices in Detroit.

Edward W. Beach, general manager, Ferro Machine & Foundry Co., Cleveland, has ben elected president of that company, succeeding Crispin Oglebay, who has been made chairman of the board of directors. Mr. Beach will continue as general manager. Mr. Oglebay has retired from the presidency in order to give more time to Oglebay, Norton & Co., in which firm he is interested.

Philip D. Wagoner has been elected president of the Elliott-Fisher Co., Harrisburg, Pa., manufacturer of calculating machines, resuming a position he relinquished at the close of 1919 to become associated with W. C. Durant, then president of the General Motors Corp. He retains a position on the board of directors. Kenneth B. Schley remains as chairman of the board.

Fred R. Eaton, cashier of the Kalamazoo National Bank, Kalamazoo, Mich., has been elected to membership on the board of directors of the C. G. Spring Co. This action took place at a special meeting of the directors of the organization he'd early in the month and Eaton's acceptance is generally thought to add conservative strength to the organization and accordingly is described as meeting with general favor.

W. G. Jarman, general manager and secretary-treasurer of the Hamilton Motors Co., manufacturers of the Panhard motor truck, Grand Haven, Mich., has resigned, taking effect immediately. Jarman prior to the Panhard connection was sales manager of the Jackson Automobile Co., prior to that Canadian manager for Briscoe, and earlier was connected with Maxwell-Briscoe and Ford.

A. B. Jones, a vice president of the B. F. Goodrich Rubber Co., has resigned as a member of the executive board of the company. He continues however as a Goodrich official, where he has become known particularly for his work as administrator of the big plant at Akron. It was as director of this work that he was elected a second vice president early in 1918.

John G. Perrin, well known as an engineer, has become associated with Stevens Duryea, Inc., Chicopee Falls, Mass., in a consulting capacity. Perrin, who has long been active in the industry, for several years past has been in charge of Knight engine production for Willys-Overland, Ltd., the Canadian arm of the Overland business.

J. G. Melbrod, during the past 4 years in charge of the Titanium Bronze Co. foundry, has made connections with the Hills-McCanna Co., Elston avenue, Chicago, and assumes charge of their foundry. He was previously with the Lumen Bearing Co., also of Buffalo, both of which companies specialized on automobile worm wheels.

F. W. Hohensee, vice president in charge of production of the Chevrolet Motor Co., New York City, has resigned and terminated his connection with the General Motors interests. Hohensee had long been associated with the Chevrolet business and had much to do with the creation of the line.

H. M. Daniels, back after an absence of more than eighteen months in the interest of the export business of the Four Wheel Drive Auto Co., Clintonville, Wis., has been appointed manager of the company's New York branch.

H. V. Goodenough, for the past six years general manager of A. J. Miller & Co., Bellefontaine, Ohio, has severed his association with that organization to join the Lorraine Car Co., Richmond, Ind. In his new work Goodenough will act in the same capacity as when with Miller.

Albert E. Doman, formerly vice president and general manager of the Doman Development Corp., has been made vice president and chief engineer of the company. He is now stationed at the factory at Elbridge, N. Y., having been transferred from Syracuse.

Frank B. Willis has been appointed sales manager of the Duplex Truck Co. of Lansing, Mich. Willis was formerly sales manager of the Kelley Springfield Truck Co. and has had a long and well seasoned truck training.

Dorsey W. Hyde, Jr., has left the transportation engineering division of the Packard Motor Car Co. to become assistant manager of the Civic Development Department of the Chamber of Commerce of the United States.

James N. Gunn, president of the United States Rubber Co., has been elected president of the Lincoln Highway Association, succeeding F. A. Seiberling, president of Goodyear Tire & Rubber Co., who resigned.

Bob Crowthers formerly with the Gary Motor Truck Co., Gary, Ind., is now located with Master Trucks, Inc., Wabash avenue, Chicago, in the capacity of advertising manager and assistant sales manager.

C. W. Hodges, Galesburg, Mich., has purchased the interest of Henry Lane of Kalamazoo, in the Kalamazoo Chain Co. and the name of the concern has been changed to the Hodges Chain Co. of Galesburg.

Clifford M. Sparks, formerly captain of the University of Michigan football team and who is widely known in athletics, has been placed in charge of sales for the Sparks-Withington Co. at Jackson, Mich.

Glen D. Hiller, formerly sales manager of the Nelson Motor Truck Co., has been appointed assistant general manager in charge of sales of the Triangle Motor Truck Co., St. Johns, Mich.

Arthur H. Lacey, formerly assistant engineer of the Hall-Scott Motor Car Co. and latterly chief engineer at the Moon Tractor Co., has established a consulting engineering office at Oakland, Cal.

E. G. Edwards, Chicago, for many years associated with George W. Kellogg, founder of the Kellogg Mfg. Co., has been elected to the board of directors of the Wayland Specialty Mfg. Co., Inc.

Warren C. Anderson, director of the five Ford Motor Co. corporations in Europe and chief representative of the American company, with offices in London and Paris, has resigned.

John Ericson has severed his connection with the Stromberg Motor Devices Co., Chicago, where he was engine designer. His plans for the future have not been announced as yet.

R. J. Firestone has been elected a vice president of the United States Motor Truck Co., Cincinnati. Firestone has been connected with the rubber industry for a number of years.

Meredith Mathews, formerly engineer in the tractor department of the Standard Gas Engine Co., Oakland, Cal., is now affiliated with the William L. Hughson Co., San Francisco.

M. C. Dittmann has resigned as vice president and general manager of the American Bronze Corporation, Berwyn, Pa., and become affiliated with the Metz Co., Waltham, Mass.

W. W. McMahan has severed his connection with Morgan & Wright, Detroit, and has become vice president of the Ajax Rubber Co., New York City.

L. A. Brown, formerly district manager for the United States Rubber Co., has been elected president of the Grand Rapids Tire & Rubber Corp.

F. J. Druar has resigned his position as chief engineer of the Standard Motor Truck Co., Detroit. He has not as yet made plans for the future.

OBITUARY

Andrew J. Pierce, builder of the Pierce motor car, which was the forerunner of the present Case car, died in Chicago late in January. He was born in Rochester, N. Y., in Jan., 1859, but in 1887 moved to Racine and became connected with the Racine Hardware Co. in charge of the engine production department making an oil engine. In 1892 he entered into business for himself, manufacturing a gasoline engine of his own invention which was a long step in advance, and organized the Pierce Engine Mfg. Co. After a few years he established and built a large plant at Lakeside, a suburb of Racine, and formed the Pierce Motor Co. for the manufacture of the Pierce automobile, this being an outgrowth of the engine company. The Pierce company was sold in 1910 to Case who continued to manufacture the Pierce car for two years. A new engine was then adopted and the Pierce name discontinued. Mr. Pierce was a mechanical engineer and a designer and manufacturer of gasoline engines. He has been allowed many United States patents on engines which have been used in launches, automobiles and stationary machinery and at the time of his death, had just perfected and obtained letters patent on a new engine for which he claimed great efficiency.

William J. O'Neil, founder and president of the O'Neil Rubber Co., of Akron died suddenly of apoplexy Feb. 14 while en route to his office. Mr. O'Neil resigned from the B. F. Goodrich Co., eleven years ago to establish the company.

ACTIVITIES OF AUTOMOTIVE MANUFACTURERS

Where They Are Located What They Are Doing How They Are Prospering

Acme Motor Truck Co., Cadillac, Mich., expects to resume shipments and large scale production on March 1. This was revealed at the recent annual meeting at which the following board of directors was re-elected: Henry Ballou, John Wilcox, D. B. McMullen, C. F. Williams, F. O. Gaffney, Henry Kknowlton, W. A. Kysor, C. J. Helm and Frank Bowen. The board elected officers as follows: President, W. A. Kysor; vice president, J. P. Wilcox; secretary, C. J. Helm; treasurer, Henry Knowlton.

Dodge Brothers, Detroit, manufacturers of automobiles, are arranging plans for the continuance of their building program now under way, increasing the appropriation to $6,000,000 for expansion purposes. The entire plant, as projected, will have a total floor area of about 100 sq. acres; the main building will consist of about 860,000 sq. ft., and will supplement an eight story structure now being finished with floor space aggregating 140,366 sq. ft.

Twin Ports Steel & Tractor Co., Superior, Wis., organized several months ago, has acquired the interests of the Evered Foundry & Machine Co. of the same city. The manufacture of gas tractors, hoisting engines and power winches will be continued, and in addition several new lines will be added. A jobbing department also has been established for pattern, casting and machine work.

LaPorte Tractor & Foundry Co., LaPorte, Ind., has completed its plant at East Lincolnway and the Lake Erie & Western Railroad and will commence operations on or before April 1. The structure is 100 x 200 ft. The plant is not connected with the parent plant in Benton Harbor, Mich., although the same men who started the latter factory organized the LaPorte company.

Kelsey Motor Co., Newark, N. J., at the annual stockholders meeting elected the following officers and directors: Ernest B. Slade, president; C. W. Kelsey, vice president; Thomas J. Stewart, treasurer; F. D. Dorman, secretary and assistant treasurer. Directors: E. J. Churchill, A. E. Jennings, John R. Thomas, Charles W. Hoyt, Charles Abbott, E. I. R. Cadmus and L. S. Tyler.

Triangle Truck Co., St. Johns, Mich., has received an order for 3,750 trucks from the Attick-Shoecraft Co., Kansas City, and also substantial increases in shipping schedules from dealers and distributors. It is stated the company will be forced to take on additional men and make an addition to its plant and equipment.

Southern Truck & Car Corp., large manufacturers of motor trucks, is now in the hands of a receiver, Garland Daniel, Greensboro, N. C., where the plant is located, having been appointed. This action has been taken, it is claimed, to protect the stockholders of the company. It is capitalized at $1,000,000.

Advance Truck Co., Los Angeles, manufacturer of trucks and parts, is having plans prepared for a new two story, reinforced concrete factory, 100 x 150 ft., at Yale and Alpine streets. Benjamin J. Bloser, 523 Consolidated Realty Building, is architect.

Do-It-All Tractors Corp., New York, recently incorporated with a capital of $100,000, will manufacture a combination plowing and cultivating motor driven tractor, with adjustable bull wheels. Headquarters will be at 202 Fulton street, New York.

Factor Motor Trucks, Inc., Springfield, Mass., has been incorporated with a capital of $500,000 by Adolf A. Geisel and Herman G. Farr, Springfield; and William V. Baldwin, Wilbraham, Mass., to manufacture automobile trucks and parts.

Ideal Tractor Cultivator Co., McCall Building, Memphis, Tenn., manufacturer of motor tractors and agricultural machinery, has acquired a local building, to be remodeled and extended for a new plant. R. F. Carr is president.

Ellis-McIntyre Motors, Ltd., Hamilton, Ont., has been incorporated with a capital stock of $150,000 by Daniel L. McIntyre, Willoughby Ellis, Charles E. Sellens and others to manufacture automobiles, trucks, tractors, etc.

London Motors, Ltd., London, has been incorporated with a capital stock of $1,000,000 by William R. Stansell, Thomas A. Conley, Thomas H. Griffith and others, to manufacture motors, engines, automobiles, trucks, etc.

H. M. Holden, Corpus Christi, Tex., and associates, have organized the Holden Tractor & Implement Co., to manufacture motor driven tractors and parts.

Body Builders

H. & M. Body Corp., Racine, Wis., recently formed by Hupmobile and Mitchell interests, and which has purchased Plant No. 2 of the Mitchell Motors Co., has received orders for several thousand automobile bodies and filling of the orders will begin just as soon as necessary plans, tools and material arrive. The placing of such a large number of automobile bodies means the operating of the local plant to full capacity and will give employment to several hundred men. Mr. Kerr, manager of the plant stated that the outlook of the season's business is bright because of automobile companies placing orders for bodies. The H. and M. Body Corp. will build bodies for the Hupmobile and Mitchell automobiles as well as for other companies.

Auto Body Co., Detroit, balance sheet for Dec. 31 showed assets of $2,674,906.02 and a surplus of $48,035.28. Current assets were $1,515,006.50 and current liabilities $1,070,490.69 compared with current assets of $1,211,709.04 and current liabilities $714,934.39 in 1919. Working capital at the end of 1920 was $444,515.81 against $496,934.63 a year ago. Fixed assets were $1,095,329.57 against $1,090,743.06 in 1919. Outstanding preferred stock amounted to $531,500, an increase from $527,600 during the year, and outstanding common was $1,018,500, an increase from $1,017,400. Total assets for the previous year were $2,339,216.29 and surplus $49,782.

Mercury Body Co., 503 Marion E. Taylor Building, Louisville, is arranging for the purchase of machinery for the manufacture of automobile bodies. Construction is under way on a one story building, 60 x 235 ft., with departments to include machine shop, sheet metal working, enameling, wood working and power house. It is proposed to develop a capacity of about 40 automobile bodies per day. C. T. McCormick is general manager.

Gus Edwards Truck & Cab Body Co., recently organized and incorporated in Paducah, began operation Feb. 14. The company will manufacture automobile truck and cab bodies, orders already received amounting to about $15,000 according to President Gus Edwards. It will be the only institution of the kind in this section and a large business is expected to be built up by officals of the company.

Acme Body Works, Appleton, Wis., established about two years ago to manufacture automobile and motor truck bodies, etc., has incorporated its business without change of style. The capital stock is $60,000. The incorporators are C. C Seeger and George W. Wiegand, the principal owners.

Rupp & Briscoe, Portage, Wis., body and wagon manufacturers, have arranged to open a large, modern plant, equipped with the most approved machinery. Skilled wagon builders have been engaged and it is expected that the company will be in full operation in a very short time.

Western Body Mfg. Co., 736 Third street, North, Minneapolis, Minn., manufacturer of automobile bodies, is having plans prepared for a new three story and basement factory. Bell & Kinsport, Hawkes Building, are architects.

Holbrook Co., West End avenue and Sixty-seventh street, New York, manufacturer of automobile bodies, has plans under way for a new one story plant at Hudson, N. Y., 100 x 260 ft. John Graham is president.

Wegner Utility Auto Body Co., Goshen, Ind., has been incorporated with a capital of $59,000 by E. H. Hewit, F. A. Wagner and E. S. Olson, Goshen, to manufacture automobile bodies.

Index To Advertisers

FOREIGN AND DOMESTIC MANUFACTURING INQUIRIES

The following inquiries, offering manufacturing and merchandising opportunities, have been received recently and are offered to subscribers and friends of Automotive Manufacturer for what they are worth

DOMESTIC INQUIRIES

1—New spark plug, guaranteed to operate in oil or money back. Seeking additional sales outlets, preferably middle western and western states.

2—Importer of highest grade French spark plug with many points of individual merit would like to hear from manufacturers in the market for something better.

3—Michigan body firm is about to come into the market for malleable iron and drop forged parts and fittings to be used in manufacturing truck bodies and cabs.

4—Engine inventor with several patents would like to arrange with large reputable engine manufacturer for construction and demonstration of ringless piston now and other features later, with view to making permanent arrangement after successful demonstration.

FOREIGN INQUIRIES

34260—A commercial agent in Argentina desires to secure the exclusive agency for the sale of lubricating oils and greases. Quotations should be given c.i.f. Argentine port. Reference.

34261—A merchant in Spain desires to secure an agency for the sale of agricultural tools, automobiles and hardware. Quotations, c.i.f Spanish port. Reference.

34266—A mercantile firm in Egypt desires to secure the exclusive agency for the sale in Egypt and Sudan of motor cars and tractors, rubber tires, agricultural machines and tools, timber and chemicals. Quotations, c.i.f. Alexandria. Payment to be cash against documents on arrival of goods. References.

34283—A merchant in Canada desires to purchase shock absorbers for heavy automobiles and an electric lighting plant for country house, automatic without storage battery, of not less than 1,500 watts. Quotations, f.o.b. point of shipment. Payment to be cash. Reference.

34288—A mercantile firm in Australia desires to secure exclusive agencies from manufacturers for the sale of automobile accessories, automobile brake lining, malleable iron pipe fittings, carpenters' and mechanics' tools, labor saving machine tools, hardware and electrical fittings of all kinds. Catalogues are requested. Quotations, f.o.b. New York or c.i.f. Australian port. References.

34294—A trading company in the Netherlands desires to secure an agency for the sale of motor cycles, bicycles, bicycle frames and accessories, and similar articles. Quotations, c.i.f. Amsterdam or Rotterdam. Payment to be made upon receipt of goods Reference.

34295—A commission company in Madeira desires to secure agencies for the sale of pneumatic tires, textiles, linens and varnish. Correspondence in Portuguese. Reference.

34296—A merchant in Australia desires to secure catalogues and prices of tractors and trucks especially designed for log hauling through forests and for road transport; and also of tackle and equipment for handling, loading, and unloading logs. Quotations, c.i.f. Australian port. Reference.

34298—A commercial representative in South Africa desires to secure an agency on a commission basis from manufacturers for the sale of paints, spraying machine for paints, incandescent kerosene oil lamps and motor cycles. References.

34299—A merchantile company in Norway desires to secure an agency for the sale of machinery, automobiles, accessories and electric specialties. Quotations, c.i.f. Norwegian port. Payment to be made through banks in Norway and in New York. References.

34319—A merchant in the French West Indies desires to secure catalogues in French of articles which he plans to purchase, such as two passenger automobiles of from 6 to 12 h.p., rubber and leather fabrics for hoods, inner tubes, pumps, motor oil, grease, gasoline, carburetors, storage batteries, spark plugs, insulated wire, kerosene motors for electric lights, all to be of the best quality, and articles not already represented in those islands.

34324—An importing firm in India desires to be placed in touch with manufacturers and exporters for the purchase of hardware, machinery, electrical goods, metals and metal products, pipes and fittings, motor cars, bicycles and accessories. Reference.

34328—A commercial agent in Argentina desires to secure the representation of firms for the sale of general lines of hardware and automobile accessories. Quotations, f.a.s. New York or c.i.f Buenos Aires. References.

34334—A New Zealand purchasing agent desires to secure agencies for electrical appliances, including household devices, automobile accessories and hardware. References.

34346—A merchant in Bulgaria desires to purchase and later secure an agency for a thrashing machine and traction engine not greater than 10 horsepower, without the apparatus for making small chaff. Quotations c. i. f. Varna. Terms: Cash payments, or arrangements may be made. Correspondence in Bulgarian or French.

34350—A firm of commission agents in India desires to get in touch with American firms for the importation of hardware of all kinds, wire goods, tool and spring steel, vises, anvils, railway stores, machinery, electrical goods, glassware, enameled ware, mild steel, bars, plates, angles, etc.; corrugated sheets, plain galvanized sheets, brass and copper sheets and rods, motor cars and motor cycles and parts. Agencies desired for sale in British India, Burma and Ceylon. Reference.

34351—A commercial agent in Spain desires to secure the representation of firms for the sale of agricultural machines and tools, automobiles and accessories, hardware, saws, paints and varnishes and labor saving devices of all kinds. References.

34367—A commercial agent in Egypt is planning to open showrooms for the exhibition and sale of tractors, trucks, oil engines, agricultural machinery, motor cars, tires, etc., and desires to secure the representation of firms with a view to advertising and selling American goods.

34380—A commission merchant in Syria desires to secure an agency for the sale of agricultural implements, including tractors of the "tank" type, and other motor apparatus for use in commencing scientific farming. Quotations c. i. f. Beirut or Alexandretta. Terms: Payment against documents, or 20 per cent in advance and balance against documents. Correspondence in French or Arabic. References.

34392—A commercial agent in Spain desires to secure the representation of firms for the sale of grinding and sharpening machines, automobile supplies, paints and varnishes. References.

34411—A machinery importing firm in Spain desires to secure an agency from manufacturers and exporters for the sale of iron and steel sheets, ingots and castings, automobiles and motor trucks, mineral oils, petroleum, etc. Quotations, c. i. f. Spanish ports. Correspondence in Spanish or French. References.

34413—A commercial agent in Italy desires to secure an agency for the sale of metals, oils and greases, belting, leather articles, automobile parts and accessories and hardware. Quotations c. i. f. Genoa. To arrange for opening of credit with American banks. References.

34428—A manufacturer's representative in Mexico desires to secure an agency for the sale of leather such as kid, calf and patent. No reference offered.

34433—A mercantile company in the Straits Settlements desires to secure an agency for the purchase of rubber. References.

34438—A commercial agent in Siam proposes to carry on business in that country as importer and distributor and desires to secure an agency for the sale of motorboat engines, motor trucks, automobiles and automobile supplies. No reference required.

34446—A merchant in Algeria desires to purchase and secure an exclusive agency for petroleum for fuel. He desires at first one tank steamer of about 2,000 to 3,000 tons. Five of such cargoes will be required annually. Quotations c. i. f. Algeria. Payments against documents either in New York or Algiers. References.

34454—A merchant in Germany desires to be placed in touch with manufacturers for the importation of machine tools, especially lathes, shapers, drill presses, etc. No references.

34460—A merchant in Chile desires to be placed in communication with manufacturers for the sale of paints, oils and varnishes in Chile. No reference.

34468—A manufacturing company in Belgium desires to secure an agency for the sale of medium priced automobiles. Quotations, c. i. f. Belgian port. Reference.

34470—The American representative of a firm in Scotland is about to return to that country and desires to secure an agency for the sale of iron and steel products and hardware. References.

34472—A commercial agent in Syria desires to secure the representation of firms for the sale of automobiles and hardware. Quotations c. i. f. Beirut or Alexandretta. Terms: Twenty-five per cent in advance and balance against documents. Reference.

34473—A request has been received from a man in Yucatan for catalogues of gasoline launches. No reference.

34478—An industrial organization in The Netherlands desires to purchase and secure an agency for the sale of tools and steel, pig iron, steels, lumber, etc. Quotations, c. i. f. Rotterdam. Terms: Cash against documents. Reference.

34489—A mercantile company in Ireland desires to secure an agency for the sale of high-grade automobile tires. No reference.

34491—A request has been received from a firm in Spain for tenders for the supply of large quantities of gasoline and steel drums for automobiles and stationary engines. Quotations, c. i. f. Spanish port. No reference.

34506—A commercial agent in France desires to secure the representation of firms for the sale of kerosene, gasoline and lubricating oils. Quotations, c. i. f. French port. References.

34511—A merchant in France desires to secure an agency for the sale of tires, tubes and automobile accessories. Quotations, c. i. f. French port. Correspondence in French. References.

34533—A merchant in India desires to be placed in communication with firms for the purchase of all kinds sporting goods, bicycles, motorcycles and automobiles and accessories. Quotations, c. i. f. Indian port. Reference.

The foreign inquiries are received mainly through governmental sources, and consequently some delay in reforwarding these must be expected. Answers should comply with the following simple rules: 1. Write one inquiry and only one on each sheet. 2, Give the number set against the inquiry below. 3. Write on your own business letterhead. Address, Commercial Inquiry Dept., Automotive Manufacturer, Heptagon Building, 153 Waverly Place, New York.

Automotive Manufacturers Recommend "SULPHO"

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Manufacturers of Nash Cars and Trucks
KENOSHA WISCONSIN

Feb. 2, 1920.

Keystone Oil & Mfg. Co.,
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Gentlemen:

We have during the last few months used several barrels of your Sulpho High Speed Cutting Oil to our entire satisfaction.

You will be pleased to learn that this oil has been tried and used particularly on very difficult and hard jobs where other oils have not given the desired smoothness and finish.

Trusting the above may be of interest to you, we remain

Yours very truly,
Nash Motors Co.

E.F. Division Superintendent.

Send for our booklet on Sulpho
Just off the press

You can increase your cutting speed to 100 lineal feet per minute

Think what that means to you in increased production. We maintain that the use of Sulpho in your machines will enable you to increase the speed to maximum. The cooling action of Sulpho will more than double the life of your dies and cutting tools. The slight abrasive quality of Sulpho will result in brighter and smoother products.

Large automotive manufacturers are using Sulpho exclusively for thread cutting, broaching, milling, gear cutting, automatic screw machine work, etc., and are turning out more work, better work at less expense in dies and tools.

If you will try a drum of Sulpho Cutting Oil at 45 cents a gallon f.o.b. Robinson, Ill., on a strictly approval basis, using a sufficient amount on the hardest work in your plant, we will guarantee to refund the entire purchase price if Sulpho fails to meet your requirements.

The services of our engineering department, consisting of practical shop men versed in cutting oils, are at your command. They will be pleased to assist you in your cutting oil problems. Do not fail to ask for a copy of this important booklet just off the press.

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